FINAL REPORT

STATE BOARD OF EQUALIZATION

OFFICE OPTIMIZATION STUDY

August 8, 1997

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Mr. Dade Powers
State Board of Equalization
450 N Street, MIC #21
Sacramento, CA 95814

RE: Board of Equalization
Office Optimization Study

Dear Dade:

We are pleased to present this final report for your review. We have spent the past several months investigating and analyzing the existing building, systems, furniture, and user impacts to explore avenues for increasing building efficiency. The results of our analysis are included in this report.

It has been a pleasure to work with you and the staff at Board of Equalization. The entire staff was very helpful and cooperative in answering questions, supplying plans, and generally assisting us in gathering information. The accuracy and detail of the base information in this report is so much the better for all your help.

The options and impacts of increasing population density are highly interactive, and there is no clear simple answer. We have tried to organize the results of various options as concisely as possible for you review. We will be pleased to assist with presentations or further capsulization of these results should you desire.

Very truly yours,

DREYFUSS & BLACKFORD ARCHITECTS

Peter M. Saucerman, AIA

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1 EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Purpose

The purpose of this study is to identify the feasibility of increasing the office population in the Board of Equalization headquarters at 450 N Street. This study includes constraints to such expansion (mechanical, electrical, elevator etc.) and projects probable, relative costs for each option explored.

Existing Conditions

- 24-floor office high-rise structure; 460,000± useable square feet (SF).
- Designed for 2,200; currently 2,300+ employee population.
- Existing electrical and data systems are adequate, but have limited expansion capacity.
- Existing mechanical systems have inadequate airflow capacity on certain floors due to high occupancy loading.
- Existing vertical transport system (VTS) is over extended at high-rise bank (floors 14 - 24); adequate at low-rise bank.
- Existing modular workstations are primarily 8' X 9'.

Reconfiguration Analysis

Option 1 - Converts two 8' X 9' workstations into three by inserting a third person. A total addition of 505 workstations (22% increase) is possible, at an estimated cost of $1,259,500, plus staff relocation costs.

There are significant drawbacks:

- Cumulative population exceeds mechanical capacity; would require air distribution upgrades at significant additional cost.
- Population exceeds electrical capacity; would require significant new panels, circuits and distribution.
- Third station is undersized, poorly configured for work.
- Privacy and efficiency is severely impacted; staff resistance
- Population exceeds elevator capacity at both low-rise and high-rise banks.

Option 1 significantly exceeds infrastructure capacity (mechanical, electrical and elevator) and is not recommended.

Option 2 - Converts three 8' X 9' workstations into four equal 6' X 9' workstations with shared circulation. Additional workstations are as follows:

Floors 2 - 11: 131 workstations (6% increase) at an estimated cost of $405,000 plus staff relocation costs.

Floors 14 - 24: 116 workstations (5% increase) at an estimated cost of $361,900 plus staff relocation costs.

Advantages include:

- Equal-sized stations, layout & amenities similar to existing.
- Efficient circulation aisles.
- Cumulative population increase is within cooling capacity of existing system; can be accommodated with addition of fan coils and air balance changes.

Drawbacks are as follows:

- Option 2 exceeds elevator capacity at the high-rise bank (floors 14 - 24).
- It also exceeds mechanical capacity at several floors. However, new fan coils can be added to mitigate the additional mechanical loads.
- Some loss of storage and privacy at new stations.

Option 3 - Reconfigure all workstations to current State Allocation Manual (SAM) standards (8' X 8').

Option 3 provides no appreciable increase in total workstation count, at a significantly higher cost than either Option 1 or Option 2.

Summary of Findings

- **Option 1** would increase population by up to 22%. This exceeds most building system capacities, resulting in significant costs for additional infrastructure - mechanical, electrical and data. Building systems would be operating at nearly 100% of total capacity, significantly increasing maintenance costs, shortening useful life and eliminating any possible reserve in the event of system failure. New workstations are poorly configured and significantly smaller than existing; all converted stations would be far short of State Allocation Manual standards for minimum workstation size.

- **Option 2** would increase population by 6% at lower levels (floors 2 - 11) and 5% at upper levels (floors 14 - 24). This is within building system capacities, but will require some additional distribution - mechanical fan coils, electrical and data wiring. New workstations are smaller than existing but with similar configuration and features. They are slightly smaller than SAM standards, but with a common circulation aisle they provide useable area equal to SAM minimum standards.

- **The Vertical Transportation System (VTS)** is presently overtaxed at the high-rise bank (floors 14 - 24). Any increase in population will further deteriorate service at these floors to unacceptable levels. The low-rise bank (floors 2 - 11) presently operate adequately. Option 1, increasing population by 22% average, will overtax this bank as well, leading to unacceptable wait times. Option 2, an 11% increase, is just within the theoretical capacity. Adding more elevators is not physically or economically feasible.

Conclusions

- **Option 2 reconfiguration at lower levels, floors 2 through 11, is recommended.** This would increase population by 131 FTE (6%) at a probable cost of $405,000 ($3,085 per workstation, average). Mechanical systems would be saturated, leaving no excess capacity for recovery from shutdown or failure at the chillers. Elevator wait times will increase, approaching the limits set by the State and possibly exceeding these limits at peak periods. Congestion in the building will likely increase, with impacts evident at the cafeteria, toilet rooms, parking and other support functions.

- **Option 2 at floors 14 through 24 is not recommended.** The high-rise elevator bank is presently overtaxed; adding population will further deteriorate service to unacceptable levels.

- **Option 1 is not recommended.** It would increase population by 22%, exceed building capacities and result in significant costs for additional infrastructure. The VTS cannot handle this increase and cannot be retrofitted. New stations are poorly configured and significantly smaller than existing and the minimum size as prescribed in the SAM standards.

- **Option 3 is not recommended.** A total reconfiguration provides no appreciable increase in workstation count, at a significantly higher cost than either Option 1 or 2.

2 PURPOSE, BACKGROUND, METHODOLOGY & ASSUMPTIONS

PURPOSE

The purpose of this Optimization Study is to examine the feasibility of locating additional Board of Equalization staff at 450 N Street. The steps include:

- Review existing building conditions and capacities.
- Identify options for increasing population.
- Identify constraints due to system capabilities and life safety code limitations.
- Project relative costs for adding workstations.

BACKGROUND

In 1993, the State Board of Equalization moved into a newly completed office building at 450 N Street in downtown Sacramento. The building initially provided office space for approximately 1,900 employees, with a design population of 2,200 maximum. By 1997 the population had increased to over 2,300 employees.

With a movement towards centralizing functions from outlying offices into downtown Sacramento, Board of Equalization management commissioned this optimization study to determine the capacity of 450 N Street to house additional staff.

METHODOLOGY

We first researched existing building systems through document review, field inspection and interviews with facility staff. This data was used to establish a benchmark for building performance under existing conditions and population.

We then examined two incremental options for increasing population density, projecting a maximum density increase on a per-floor basis. The system demands for the added workstations were projected using industry and code standards for:

- Structural loading
- Mechanical heat gain
- Electrical load gain
- Data/Telecom service
- Elevator travel demand
- Fire & Life Safety requirements

The added demand projections were compared against the limits of the existing building systems; changes and/or additions required were noted.

ASSUMPTIONS

- "Existing condition" documents (floor plans, HVAC operation records, telecom wiring plans, etc.) provided to us to establish population counts and other benchmarks are assumed to be accurate records.
- New workstations will require the same services and equipment as similar existing stations.
- Furniture material and installation costs will be as per current State contract.
- Supervisor workstations will be required at a ratio of approximately 1:8 to standard workstations.
- Support amenities such as parking, cafeteria and childcare were not considered.

3 EXISTING CONDITIONS

EXISTING CONDITIONS

Building, General

450 N Street comprises approximately 600,000 gross square feet (GSF) in a 24-story tower and garage facility. Floors 2 through 22 are relatively uniform plates with approximately 21,350 useable square feet (USF). Floors 23 and 24 are 14,465 USF each of office space. Workstations in the building are predominantly open plan systems furniture with primarily private offices on the top two floors.

Systems Furniture

Workstations are comprised of 62" high panels, 30" deep work surfaces and panel-hung storage units. There are generally three workstation types:

1. Atypical Specialty Stations
   (6' X 6' or 6' X 8' or 8' X 8')
   36 SF to 64 SF average

2. Supervisor Stations
   (9' X 14')
   126 SF average

3. Standard Stations
   (9' X 8')
   72 SF

There are a limited number of Type 1 stations, primarily on floors 2, 3, 11 and 19. The supervisor's stations (Type 2) are located throughout the building at a ratio of approximately 1:8 to standard stations. The majority of workstations are Type 3, standard stations. All modular furniture is the product of a single manufacturer.

Mechanical Systems

The building is served by a central mechanical plant with air distribution through fan coil units and ceiling diffusers. The system generally performs reliably and efficiently with the current building population, but there are existing air flow problems on a few of the higher density floors.

The original mechanical design was based upon an occupant density of 150 SF/person with a combined total of 3,290 people maximum. A miscellaneous equipment load of 1.5 watts/SF was used throughout. The design used 80,000 cubic feet per minute (CFM) of outside air as a minimum; that is approximately 16% of supply air. The two original chillers are operating at 80% capacity (a third 75 ton chiller was added during tenant build-out). Fans are currently operating at 90% capacity. *See Mechanical Report, Section 6.*

Electrical System

The building electrical power is supplied by two main switchboards located in the main electrical room. One service is dedicated for all mechanical loads for the building; the other service is for the building occupants, i.e., lighting, receptacles.

Both services are rated 5000 amp, 277/480 V. The main switchboard for mechanical loads is currently at 46% capacity, while the building main switchboard is currently at 39% capacity.

Typical floors have 150 kVA of 120/208 V power available. Assuming 80% of this power is dedicated to workstations, this projects to an average capacity of about 6.5 amps @ 120 V per workstation.

Telecommunications and Data Systems

1. Voice (Telephone Only):

   The building is currently utilizing an off-site PBX switch (Pac Bell CMS Centrex System). Programming is performed by Board of Equalization staff via modem.

   Maximum capacity of trunk line is 3600 pairs; currently 2200 pairs are in use.

   Telecom closet capacity is as follows:

   Floors 1 - 11 .... max. 248 voice feeds/floor
   Floors 14 - 22 .... max. 216 voice feeds/floor
   Floors 23 & 24 .... max. 124 voice feeds/floor

   Two voice jacks are provided to each station using one 4 pair cable, split with two pair to each jack. The building horizontal cabling installation does not comply with ANSI/EIA/TIA standards.

   Both Option 1 and 2 are within the current capacity of the infrastructure.

2. Data

   The building data backbone is distributed from the MDF located on the 5th floor.

   Maximum capacity of the trunk line is 3600 pairs; currently 2200 pairs are utilized.

   Telecom closet capacity is as follows:

   Floors 1 - 11 .... max. 288 low speed feeds
   Floors 1 - 11 .... max. 288 high speed feeds
   Floors 14 - 22 .... max. 216 low speed feeds
   Floors 14 - 22 .... max. 216 high speed feeds
   Floors 23 & 24 .... max. 144 low speed feeds
   Floors 23 & 24 .... max.144 high speed feeds

   Two low speed and two high speed jacks are provided to each station using two 4 pair cable, with split pairs to each jack. Low speed cable is CAT 3 and high speed cable is CAT 5. The building cabling installation does not comply with ANSI/EIA/TIA standards for horizontal cable.

   Both Option 1 and 2 will require additional active electronic equipment, i.e. hubs. Option 1 will require additional rack equipment due to the limited space available in the existing equipment rack.

3. Underfloor Distribution

   Power and data distribution is accomplished in a "Walker Duct" system throughout each floor. In many cases, this duct system is at 100% capacity with no room for additional cabling. New distribution would have to be via core-drilled monuments. This results in significant disturbance to occupants on 2 floors.

See Electrical and Data Report, Section 6.

Vertical Transportation

The building is served by an elevator system as follows:

- **Low-Rise Bank: 4 Elevators (Floors 1 through 11)**
- **High-Rise Bank: 5 Elevators (Floors 11 through 24)**
- **One Freight Elevator**

Elevator capacity is a function of the Traffic Handling Design Criteria (THDC); that is, the length of time passengers wait for service and the ability of the elevator system to respond to calls for service. Naturally, peak travel periods will result in longer waiting time.

The State of California has adopted industry THDC standards which call for handling 12.5% of the group population in a 5 minute peak period, with an average interval of 30 seconds or less. Performance which falls short of this (i.e. less than 12.5% handled, more than 30 second wait, or both) is considered substandard.

The low-rise bank has adequate capacity for the existing population. The *average* wait period did not exceed 30 seconds throughout the test period. While theoretical calculations indicate both Option 1 and 2 exceed capacity, the on-site observation and recorded information suggest that Option 2 could be handled by the low-rise bank.

There are currently delays which exceed standards in the high-rise bank. Testing showed waits from 15 to 75 seconds, with the average exceeding 30 seconds during peak periods. Both theoretical and on-site observation indicate that neither Option 1 or 2 are feasible. *See Vertical Transportation Report, Section 6.*

4 RECONFIGURATION ANALYSIS

RECONFIGURATION ANALYSIS

Existing Workstations

The basic workstation module is 8' X 9' or 72 square feet. This building was laid out prior to adoption of the new SAM standards for msf, which call for a standard workstation of 64 square feet, or 8' X 8'. Our first step was to examine options for optimizing within the framework of that 8' X 9' module.

Option 1 - 2:3 Change

This option removes the dividing panel between two back-to-back workstations and inserts a third smaller station, essentially using reference space within the original two (see page 10). This option has the advantage of being the least disruptive with maximum utilization of existing furniture. However, the new stations are created simply by inserting a third person into the space formerly occupied by two workers.

Disadvantages: The third station is poorly configured, with inadequate storage and work area. Existing storage is removed to create the third station, resulting in less file and storage capacity for more employees. Speech privacy is significantly decreased; circulation within workstation is awkward.

This option has been implemented in several locations in the building, with significant staff resistance.

Mechanical Impact: This option would have an occupant density around 160 SF/person and a miscellaneous equipment load of 1.3 watts/SF. The outside air could remain at 80,000 cfm.

Based on calculations, the proposed occupancy and equipment changes for Option 1 should still be within the capacity of the main cooling system (chillers, pumps, coils). Several floors, however, lack the airflow needed to serve occupancy loading. Supplementary fan systems would be needed, at significant additional cost. A more radical approach would be to enlarge the motors on the supply fans and generate higher volumes of airflow from the existing equipment. This should not be considered without also modifying bases and supports for these fans, to mitigate vibration problems. This too could have significant cost implications.

Electrical Impact: This worst case option, adding an average of 22% additional workstations, would limit existing and new workstations to about 5.0 amps @ 120 V. each, a capacity reduction of 24%(average existing station demand is at 5.9 amps.) In most cases, spare circuit breakers may not exist and additional panelboards would be required to connect the new workstations.

Telecommunication Impact: This option would require additional active electronics, i.e. hubs, to support both the low and high speed data networks. Area workgroups would also become a factor of how many hubs are required. The addition of voice drops would be required to the workstations, but the quantity shown is within the capacity of the voice system. In many locations, distribution would be via core-drilled monuments, as the underfloor duct is full to capacity.

Option 2 - 1½:2 or 3:4 Change

This option modifies the 8' X 9' module to a 6' X 9' module with a shared aisle way between two stations. Thus, 3 standard stations (24' X 9') become 4 stations (see page 14.) This option results in new stations that are equal sized, with amenities in a similar layout to the existing stations. At 54 SF the new stations are smaller than SAM standards, but the common aisle between each pair provides a useable area equivalent to the SAM standard of 64 SF.

Disadvantages: Hanging files are removed along with the separating panels, resulting in decreased storage. Speech privacy is somewhat decreased, though far better than with Option 1.

This option has recently been implemented on the 19th floor and is being tested.

Mechanical Impact: This reconfiguration is generally within the system capacity. The most densely loaded floors may exhibit some airflow capacity problems. Recommended mitigation measures are as follows:

- Adjust air temperature down a few degrees (by means of controls).
- Test hydronic system for peak capacity.
- Perform room-by-room calculation on proposed occupant loading.
- If floors still exceed airflow capacity, add new chilled water fan coil(s).

Electrical Impact: This configuration adds an average of 11% additional workstations and would limit existing and new workstations to about 5.8 amps @ 120 V each, a reduction of about 10% (average existing stations are at 5.9 amps). In most cases, spare circuit breakers may not exist and additional panelboards would be required as a minimum to connect the new workstations.

Telecommunication Impact: This option would require additional active electronics, i.e. hubs, to support both the low and high speed data networks. Area workgroups would also become a factor of how many hubs are required. Fewer hubs would be required than under the Option 1 requirements. The addition of voice drops would be required to the workstations, but the quantity shown is within the capacity of the voice system.

Vertical Transport Impact: All of the options considered here would have a negative impact on the elevator system and push the service demand beyond acceptable levels. As noted above, the service standard recognized by the State of California for a 5 minute peak period is 12.5% (minimum) of population served, with 30 second (maximum) wait period.

- Option 1: The projected population/wait ratios would significantly exceed the service standard at both the low-rise and high-rise banks.
- Option 2: The service standard would be significantly exceeded at the high-rise bank. The low-rise bank, however, has the theoretical capacity to absorb the additional projected staff.

Option 3 - Reconfiguration

Finally, we tested a complete reconfiguration utilizing 8' X 8' workstations per SAM standards. The savings of one linear foot per workstation was not enough to add additional groups between existing columns, and so simply increased aisle widths. There was little appreciable increase in population over existing, and less than either Option 1 or 2 above.

Conclusions & Recommendations

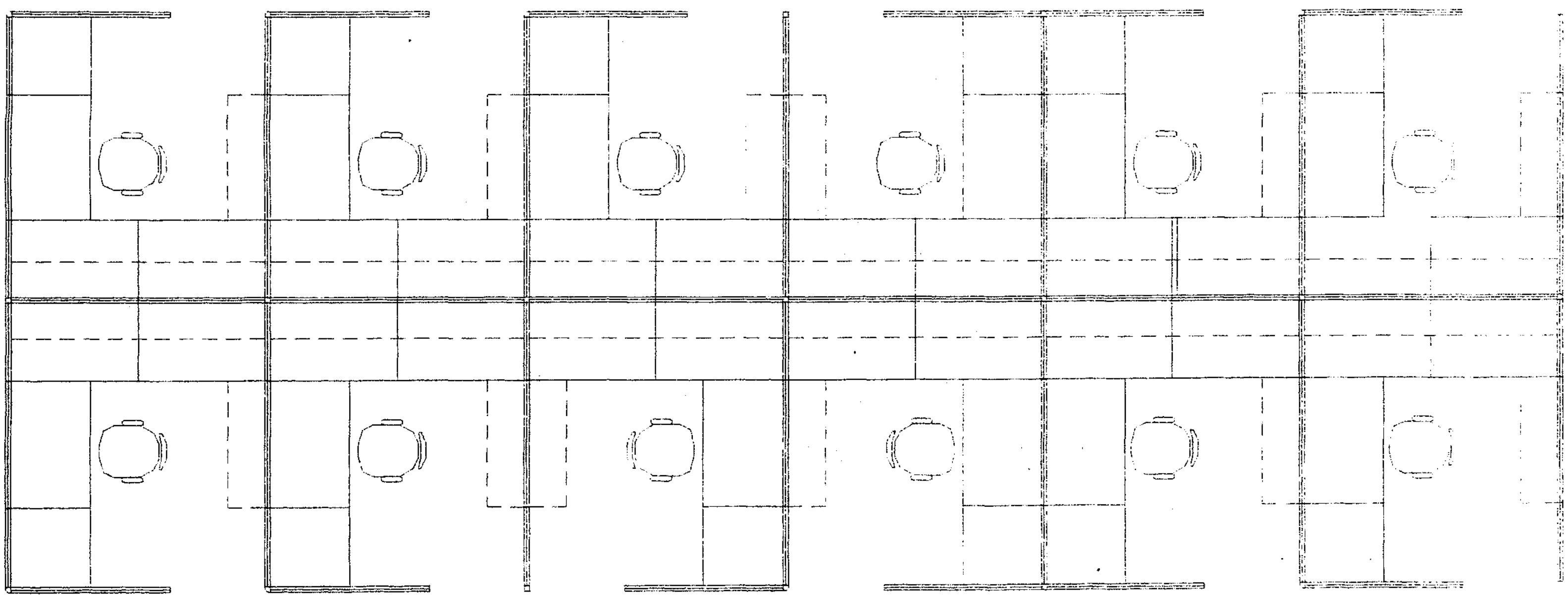
The **Option 2** approach is the most workable of those considered, but still results in overtaxing of existing systems. The advantages of this option can be summarized as follows:

- Creates equal-sized workstations in configurations similar to existing.
- Can be reconfigured incrementally, with only localized disruption of employees.
- Reuses existing components with only additional work surfaces and file drawer pedestals.
- Optimizing floors 2 through 11 (+131 staff), the existing building infrastructure can still absorb the increased demand without significant mechanical, electrical or data system changes*.
- The probable cost of this option for floors 2 - 11 is $405,000 not including staff disruption costs.

We would point out that **Option 1** is not recommended for a number of reasons:

- All of the additional workstations created are undersized and poorly configured.
- Sound privacy for all employees is significantly reduced in the converted areas.
- The maximum population increase (+505 staff) exceeds the capacity of existing building infrastructure, resulting in the need for significant changes and additions to the mechanical, electrical and data systems*.

* ***As the vertical transportation system is already overtaxed, both options would have a negative impact on elevator waiting periods. See Elevator report, section 6.***



TYPICAL EXISTING GROUP

6+6 @ 72 S.F. EACH (9x8)

EXIST. TO REMAIN
EXIST. TO BE RELOCATED/RECONFIGURED
NEW COMPONENTS

OPTION #1 - Convert Groups from 2 to 3:

Direct Costs:

Hardware - work surfaces, pedestals, pencil drawers and keyboard trays: Lump Sum $675

Installers - 2 men X 2 hrs. X $30 = ... 120

Electric/Data - 2 men X 4 hrs. X $60 = ... 480

Subtotal Direct Costs $1,275
Rounded to $1,300 per group

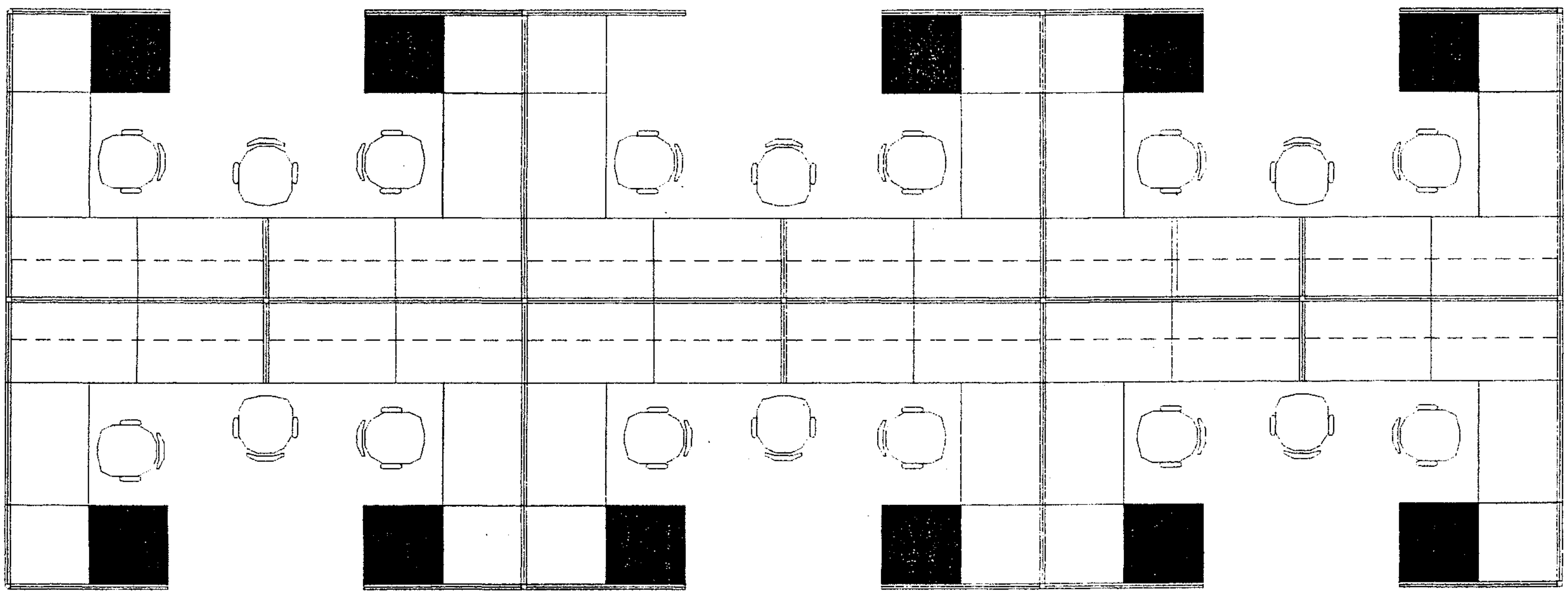
Indirect Costs:

Displacement - 2 staff @ 1 - 8 hr. day* = ... 16 hrs.

Pack/Unpack - 3 staff @ 4 hr. ea. = ... 12 hrs.

Subtotal Lost Time . . . . 28 hrs.

*** This assumes staff in adjacent work stations can work during the disruption.**



OPTION 1

CONVERT 2 WORK STATIONS (144 S.F.) INTO 3
NET CONVERSION: 18 FOR 12 (+50%)

PRO

- MINIMAL RECONFIGURATION
- USES EXISTING COMPONENTS
- MINIMAL DOWNTIME

CON

- SHRINKS WORK STATION SIZE FROM 72 S.F. TO 48 S.F.
- DECREASES STORAGE
- MIDDLE WORK STATION IS UNDERSIZED
- ACOUSTIC PRIVACY PROBLEMS

EXIST. TO REMAIN
EXIST. TO BE RELOCATED/RECONFIGURED
NEW COMPONENTS

OPTION #1

Furniture Reconfiguration

FLOOR	EXISTING WORK STATIONS	ADDITIONAL WORK STATIONS	NEW TOTAL WORK STATIONS	% INCREASE BY FLOOR	WORK STATION GROUPS 2:3	CONVERSION COSTS: COST PER GROUP	CONVERSION COSTS: TOTAL COST	AVG. COST	COMMENTS
2	141	30	171	21%	18	1,300	23,400	780	40 "Go-To" Stations approx. 36 s.f. ea.
3	115	13	128	11%	17	1,300	22,100	1,700	36 "Go-To" Stations approx. 36 s.f. ea
4	116	23	139	20%	29	1,300	37,700	1,639	
5	77	12	89	16%	16	1,300	20,800	1,733	12 "Go-To" Stations approx. 36 s.f. ea
6	113	31	144	27%	37	1,300	48,100	1,552	
7	135	39	174	29%	47	1,300	61,100	1,567	
8	142	34	176	24%	42	1,300	54,600	1,606	4 "Go-To" Stations approx. 36 s.f. ea
9	148	40	188	27%	50	1,300	65,000	1,625	
10	128	34	162	27%	42	1,300	54,600	1,606	
11	58	0	58	0%	42		0		
14	145	26	171	18%	32	1,300	41,600	1,600	14 "Go-To" Stations approx. 36 s. f. ea
15	141	40	181	28%	48	1,300	62,400	1,560	
16	127	30	157	24%	38	1,300	49,400	1,647	
17	111	27	138	24%	38	1,300	49,400	1,830	
18	125	32	157	26%	38	1,300	49,400	1,544	
19	136	20	156	15%	24	1,300	31,200	1,560	17 "Go-To" Stations approx. 36 s.f. ea
20	116	27	143	23%	33	1,300	42,900	1,589	4 "Go-To" Stations approx. 36 s.f. ea
21	111	23	134	21%	29	1,300	37,700	1,639	
22	81	12	93	15%	14	1,300	18,200	1,517	
23	32	5	37	16%	5	1,300	6,500	1,300	4 board & 4 admin. asst.
24	19	7	26	37%	5	1,300	6,500	929	32 private offices
	2,317	**505**	**2,822**	**22%**			**782,600**	**1,550**	

OPTION #1

Infrastructure Costs

DESCRIPTION	QUANTITY	UNIT COST	TOTAL	COMMENTS
MECHANICAL				
A. Fan Coils @ Floors 7 - 10, 14 - 16, 18 - 19	9	12,500/flr	112,500	
B. Air Water Balance - All Floors	L. S.		25,000	
ELECTRICAL				
A. Circuits for Fan Coils	9	800	7,200	
B. Panel Boards	16	5000	80,000	
C. Transformers	10	4500	45,000	
D. New Circuits	16	8000	128,000	
DATA/TELECOM				
A. Hub Additions	18	1200	21,600	
B. Equipment Racks	18	3200	57,600	
SUBTOTAL			476,900	
FURNITURE RECONFIGURATION			782,600	
TOTAL COST:			1,259,500	
AVG. COST/WORKSTATION			2,494	

OPTION #2 - Convert Groups from 6 to 8:

Direct Costs:

Hardware - work surfaces, pedestals, pencil drawers and keyboard trays: Lump Sum $1,500

Installers - 4 men X 8 hrs. X $30 = ... 960

Electric/Data - 2 men X 8 hrs. X $60 = ... 960

Subtotal Direct Costs $3,420
Rounded to $3,500 per group

Indirect Costs:

Displacement - 6 staff @ 1 - 8 hr. day* = ... 48 hrs.

Pack/Unpack - 8 staff @ 4 hr. ea. = ... 32 hrs.

Subtotal Lost Time . . . . 80 hrs.

*** This assumes staff in adjacent workstations can work during the disruption.**

OPTION #2 (Cont'd) Convert Groups from 3 to 4:

Direct Costs:

Hardware - Lump sum $750

Installers - 4 men X 6 hrs. X $30 = ... 720

Electric/Data - 2 men X 4 hrs. X $60 = ... 480

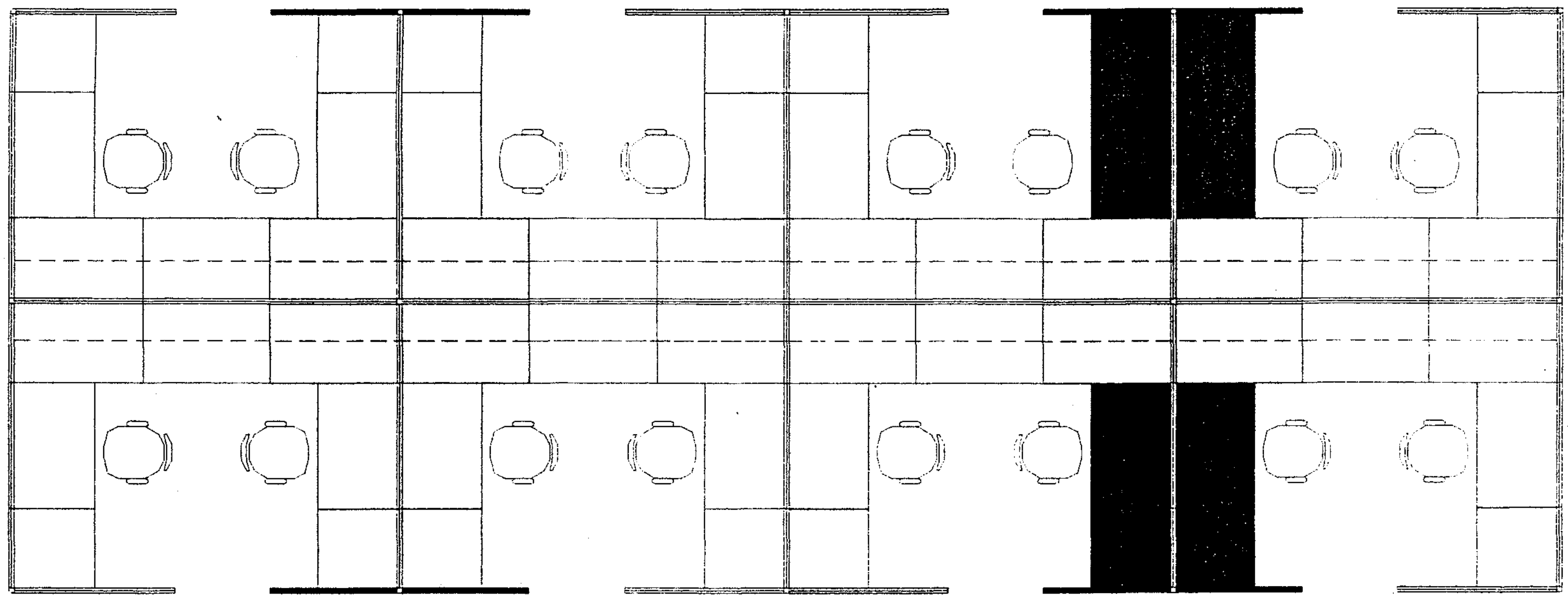
Subtotal direct costs $1,950
Rounded to $2,000 per group

Indirect Costs:

Displacement - 3 staff @ 1 - 8 hr. day* = ... 24 hrs.

Pack/Unpack - 4 staff @ 4 hr. ea. = ... 16 hrs.

Subtotal Lost Time . . . . 40 hrs.



OPTION 2

CONVERT 8'x9' WORK STATIONS TO 6'x9'
NET CONVERSION: 16 FOR 12 (+33%)

PRO

-RE-USES EXISTING COMPONENTS
-MODERATE RECONFIGURATION
-ALL EQUAL-SIZED WORKSTATIONS
-UTILIZES (E) 4' MODULE

CON

-SHRINKS WORK STATION SIZE FROM 72 S.F. TO 54 S.F.
-DECREASES STORAGE
- 'SPINE' AND ELECTRICAL RECONFIGURATION
-SHARED PAIRS - ACOUSTIC PROBLEMS

EXIST. TO REMAIN
EXIST. TO BE RELOCATED/RECONFIGURED
NEW COMPONENTS

OPTION #2

Furniture Reconfiguration

					WORK STATION CONVERSION COST						
FLOOR	EXISTING WORK STATIONS	ADDITIONAL WORK STATIONS	NEW TOTAL WORK STATIONS	% INCREASE BY FLOOR	CONVERT GROUPS @ 3:4	COST	CONVERT GROUPS @ 6:8	COST	TOTAL COST	AVG. COST PER WORK STATION	COMMENTS
2	141	23	164	16%	9	18,000	9	27,000	45,000	1,957	40 "Go-To" Stations approx. 36 s.f. ea.
3	115	13	128	11%	5	10,000	4	12,000	22,000	1,692	36 "Go-To" Stations approx. 36 s.f. ea
4	116	8	124	7%	7	14,000	1	3,000	17,000	2,125	
5	77	7	84	9%	3	6,000	4	12,000	18,000	2,571	12 "Go-To" Stations approx. 36 s.f. ea
6	113	11	124	10%	3	6,000	6	18,000	24,000	2,182	
7	135	14	149	10%	9	18,000	5	15,000	33,000	2,357	
8	142	16	158	11%	7	14,000	6	18,000	32,000	2,000	4 "Go-To" Stations approx. 36 s.f. ea
9	148	24	172	16%	6	12,000	14	42,000	54,000	2,250	
10	128	15	143	12%	7	14,000	7	21,000	35,000	2,333	
11	58	0	58	0%	0	0	0	0	0	0	
SUBTOTAL	**1,173**	**131**	**1,304**	**11%**		**112,000**		**168,000**	**280,000**	**19,468**	
14	145	6	151	4%	4	8,000	8	24,000	32,000	5,333	14 "Go-To" Stations approx. 36 s. f. ea
15	141	35	176	25%	6	12,000	14	42,000	54,000	1,543	
16	127	16	143	13%	3	6,000	10	30,000	36,000	2,250	
17	111	0	111	0%	0	0	0	0	0	0	
18	125	15	140	12%	6	12,000	8	24,000	36,000	2,400	
19	136	11	147	8%	2	4,000	4	12,000	16,000	1,455	17 "Go-To" Stations approx. 36 s.f. ea
20	116	10	126	9%	3	6,000	6	18,000	24,000	2,400	4 "Go-To" Stations approx. 36 s.f. ea
21	111	14	125	13%	4	8,000	6	18,000	26,000	1,857	
22	81	7	88	9%	4	8,000	2	6,000	14,000	2,000	
23	32	2	34	6%	2	4,000	0		4,000	2,000	4 board & 4 admin. assist.
24	19	0	19	0%	0	0	0	0	0	0	32 private offices
SUBTOTAL	**1,144**	**116**	**1,260**	**10%**		**68,000**		**174,000**	**242,000**	**21,238**	

$30,[illegible] /wksn

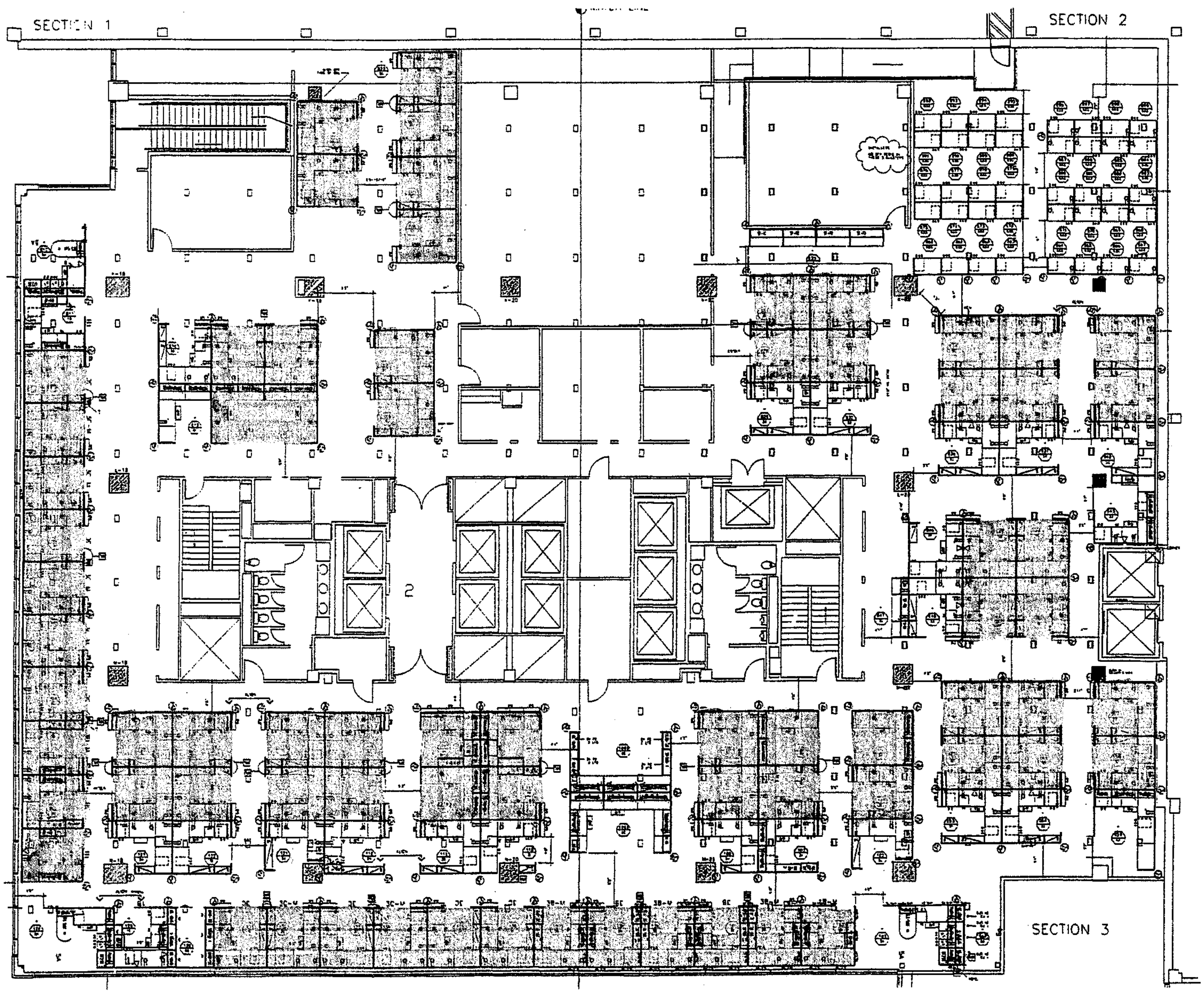
OPTION #2

Infrastructure Costs

DESCRIPTION	FLOORS 2 - 11 QUANTITY	FLOORS 2 - 11 UNIT COST	FLOORS 2 - 11 TOTAL	FLOORS 14 - 24 QUANTITY	FLOORS 14 - 24 UNIT COST	FLOORS 14 - 24 TOTAL	COMMENTS
MECHANICAL							
A. Fan Coils @ Floors 8, 9, 14 & 15	2	12,500	25,000	2	12,500	25,000	
B. Air Water Balance - All Floors		L.S.	15,000		L.S.	15,000	
ELECTRICAL							
A. Circuits for Fan Coils	2	800	1,600	2	800	1,600	
B. Panel Boards	6	5000	30,000	5	5000	25,000	
C. New Circuits	6	4500	27,000	5	4500	22,500	
DATA/TELECOM							
A. Hub Addition	6	1200	7,200	7	1200	8,400	
B. Additional Equipment Racks	6	3200	19,200	7	3200	22,400	
SUBTOTAL			125,000			119,900	
FURNITURE RECONFIGURATION			280,000			242,000	
TOTAL COST:			405,000			361,900	
AVG. COST/WORKSTATION			3,092			3,120	

5

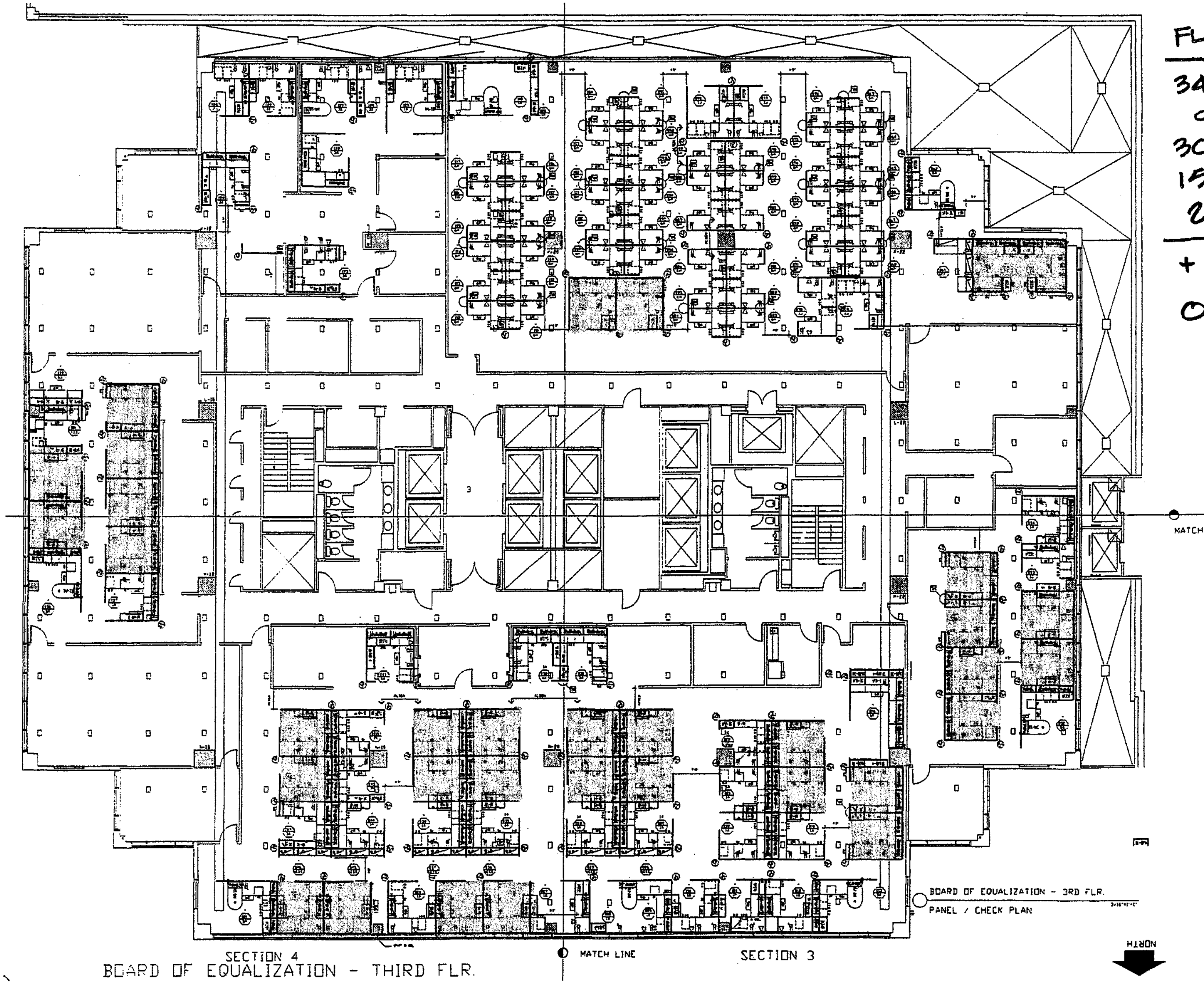
FLOOR PLATES



OPTION #1
FLOOR 2

72 (E) @ 72 ф
CONVERT TO
66 (N) @ 54 ф
33 (N) @ 36 ф
3 (N) @ 144 ф

+30 W.S.



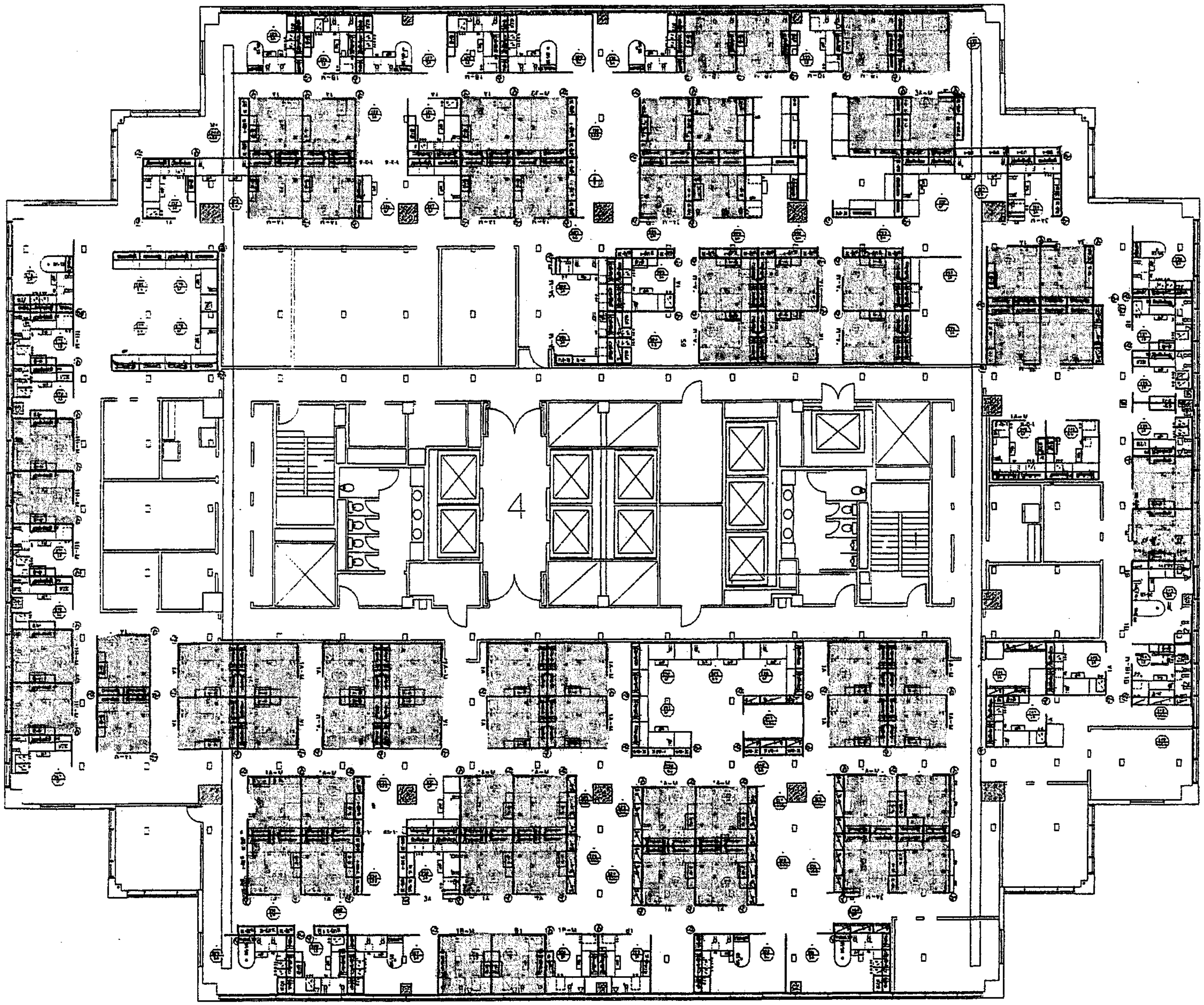
BOARD OF EQUALIZATION - THIRD FLR.

FLOOR 3

34 (E) @ 72 ⌀
convert to
30 (N) @ 54
15 (N) @ 36
2 (sun.) @ 144

+13 W.S.

OPTION #1



OPTION #1
FLOOR 4

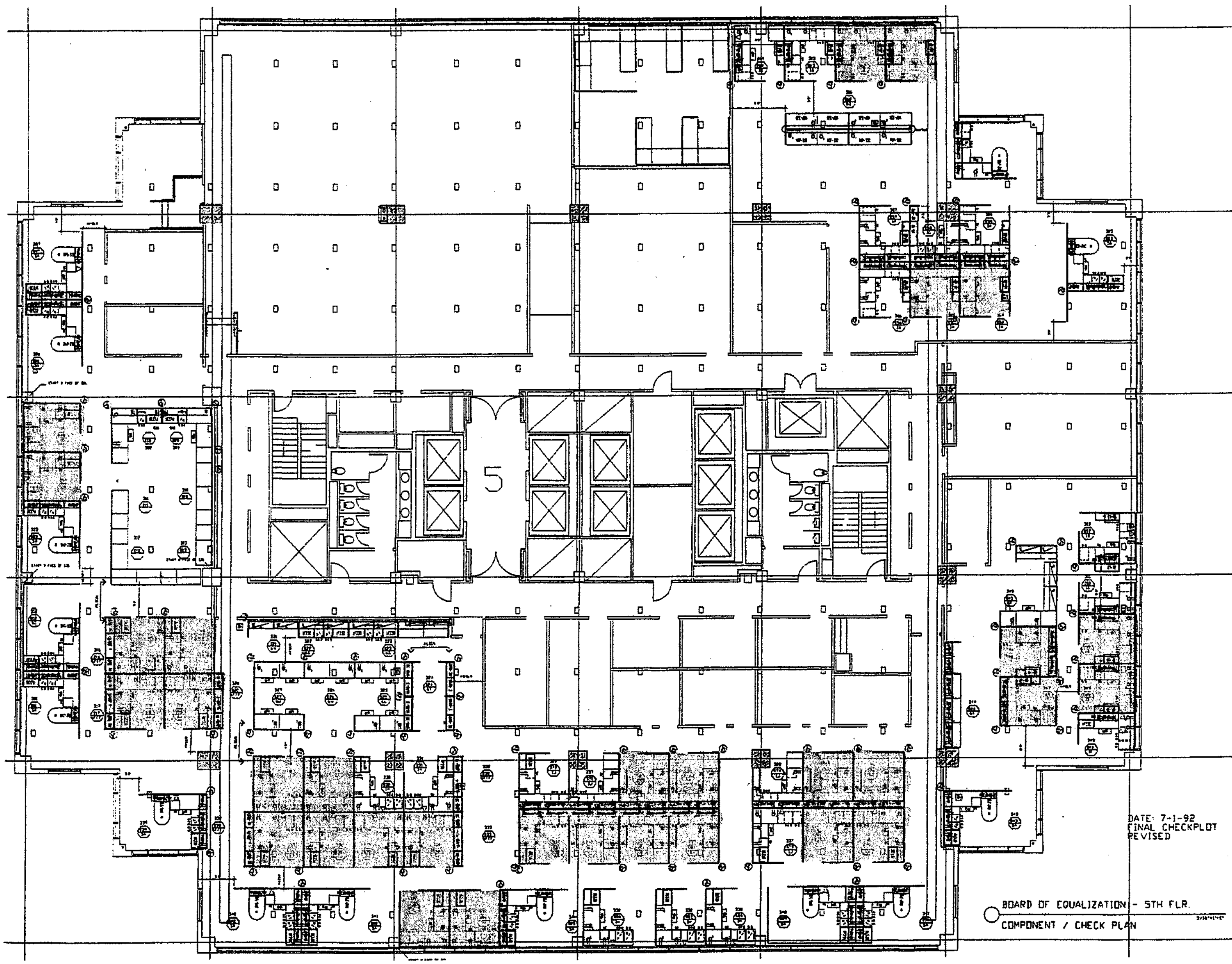
58 (E) @ 72 #
CONVERT TO
52 (N) @ 54
26 (N) @ 36
3 (SUPV.) @ 144

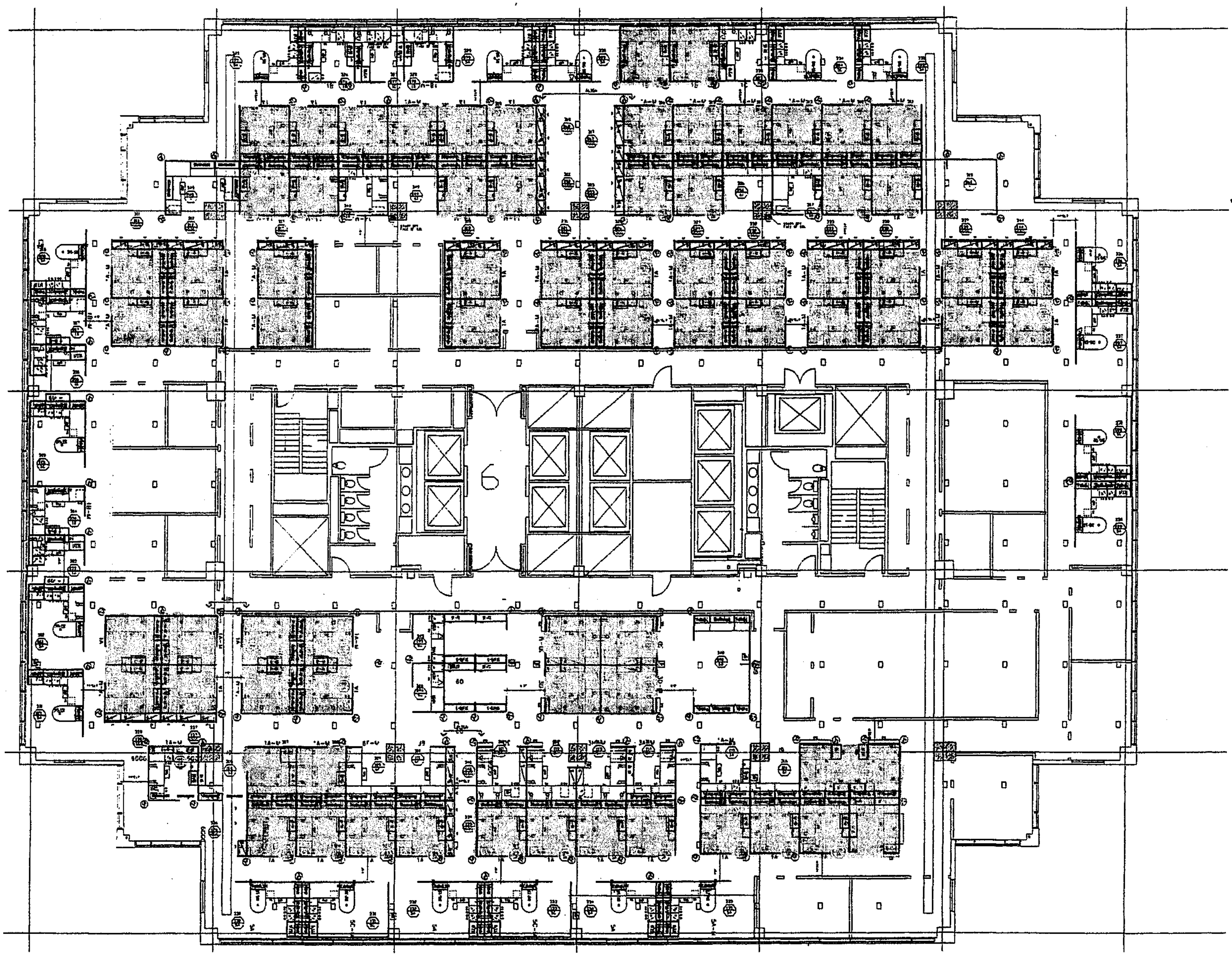
+23 W.S.

OPTION #1
FLOOR 5

32 (E) @ 72 #
CONVERT TO
28 (N) @ 34
14 (N) @ 36
2 (SUPV.) @ 144

+12 W.S.

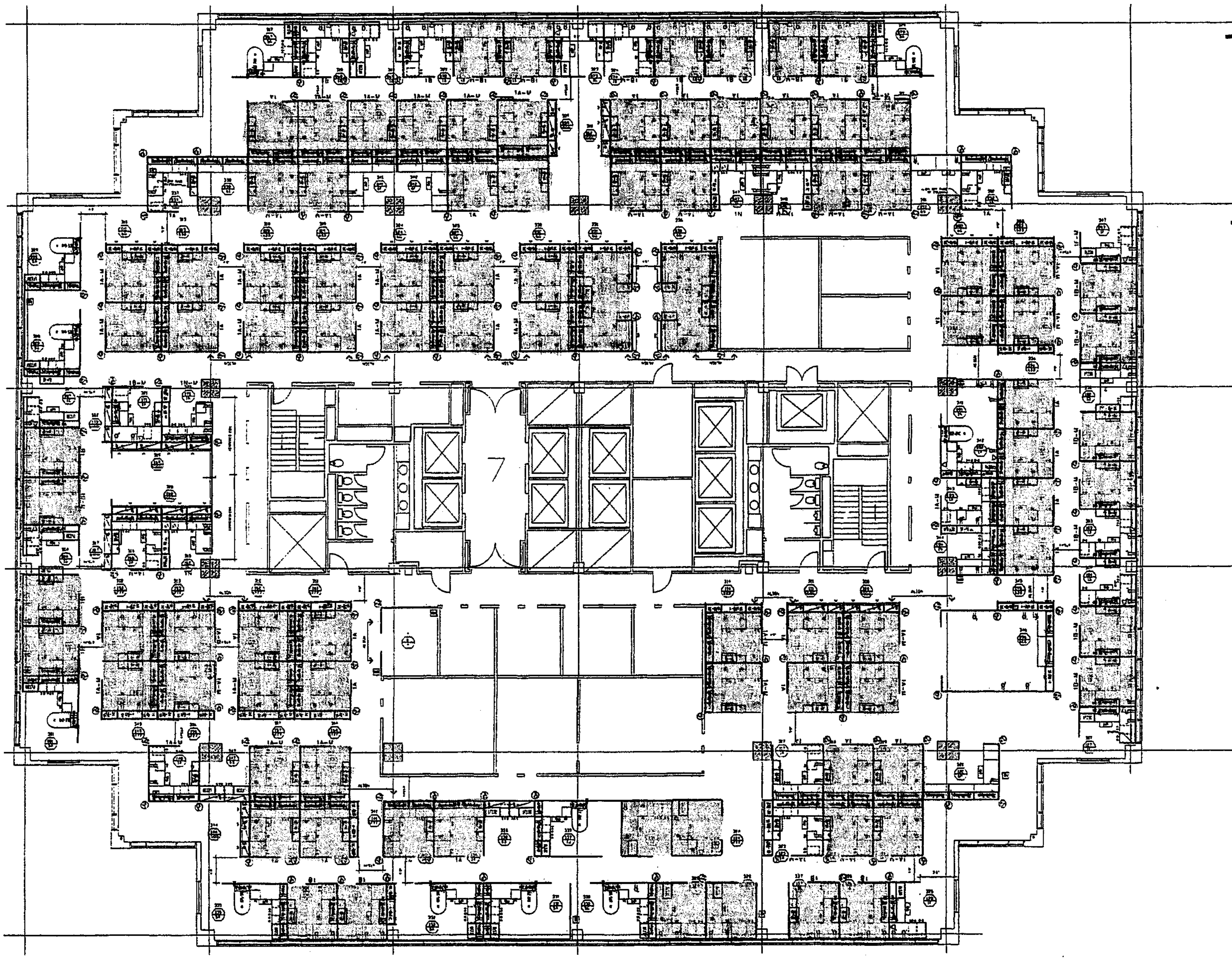




OPTION #1
FLOOR 6

74 (E) @ 72¢
CONVERT TO
68 (N) @ 54
34 (N) @ 36
3 (SUN.) @ 144

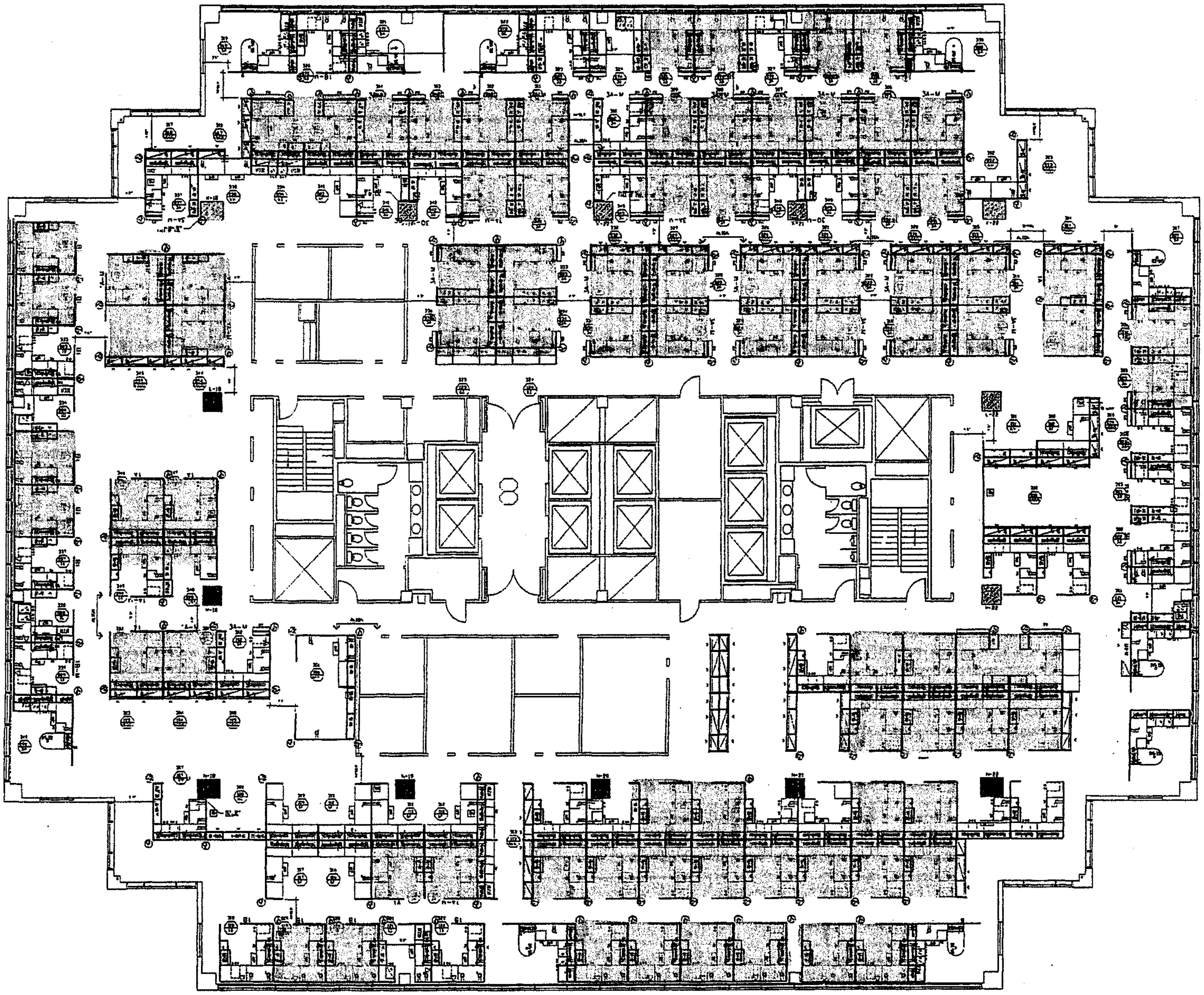
+31 W.S.



OPTION # 1
FLOOR 7

94 (E) @ 72 ¢
CONVERT TO
86 (N) @ 54
43 (N) @ 36
4 (SUN.) @ 144

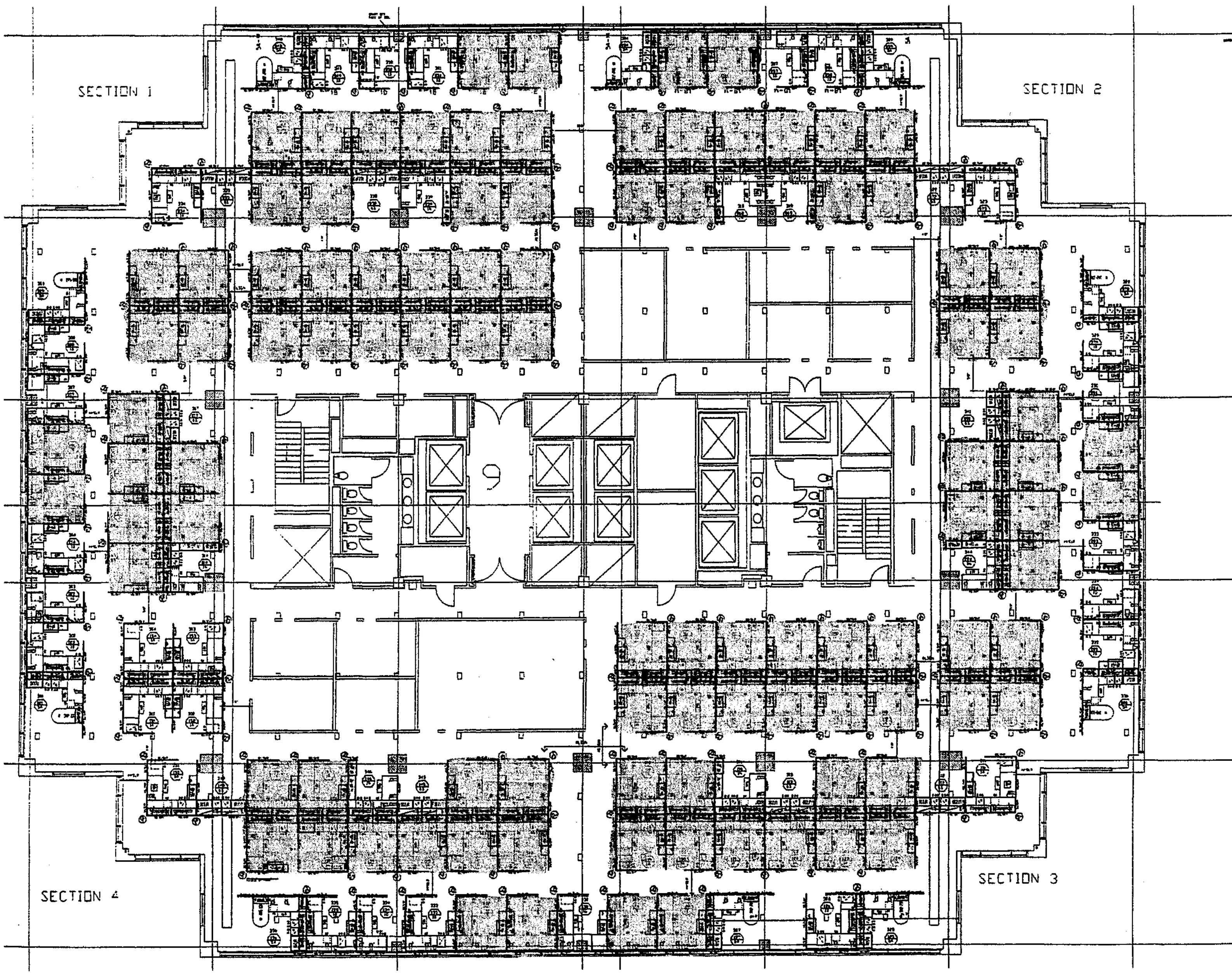
+39 W.S.



OPTION #1
FLOOR 8

84 (E) @ 72 ¢
CONVERT TO
76 (N) @ 54
38 (N) @ 36
4 (SUPV.) @ 144

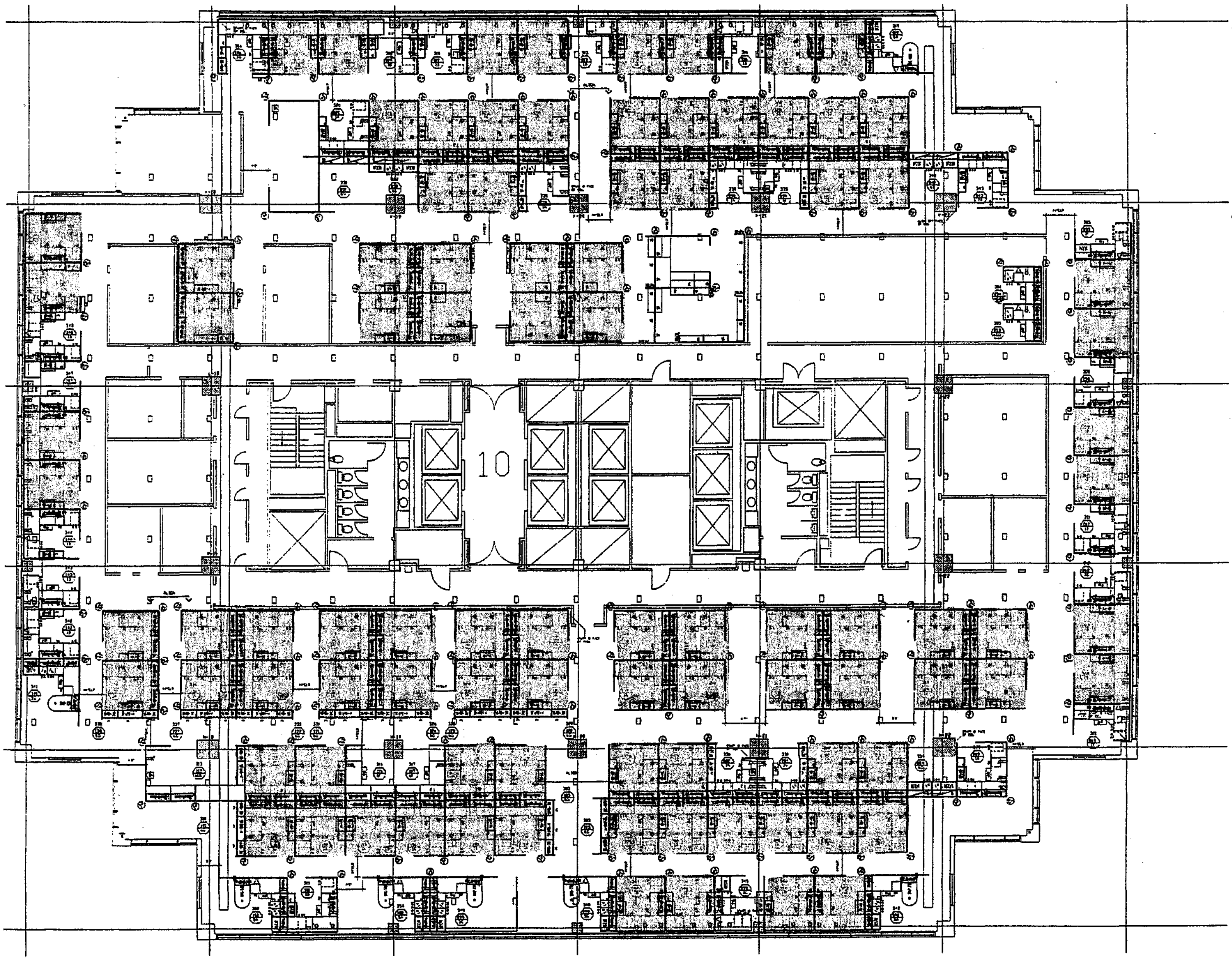
+34 W.S.



OPTION #1
FLOOR 9

100 (E) @ 72 ¢
CONVERT TO
90 (N) @ 54
45 (N) @ 36
5 (SUN.) @ 144

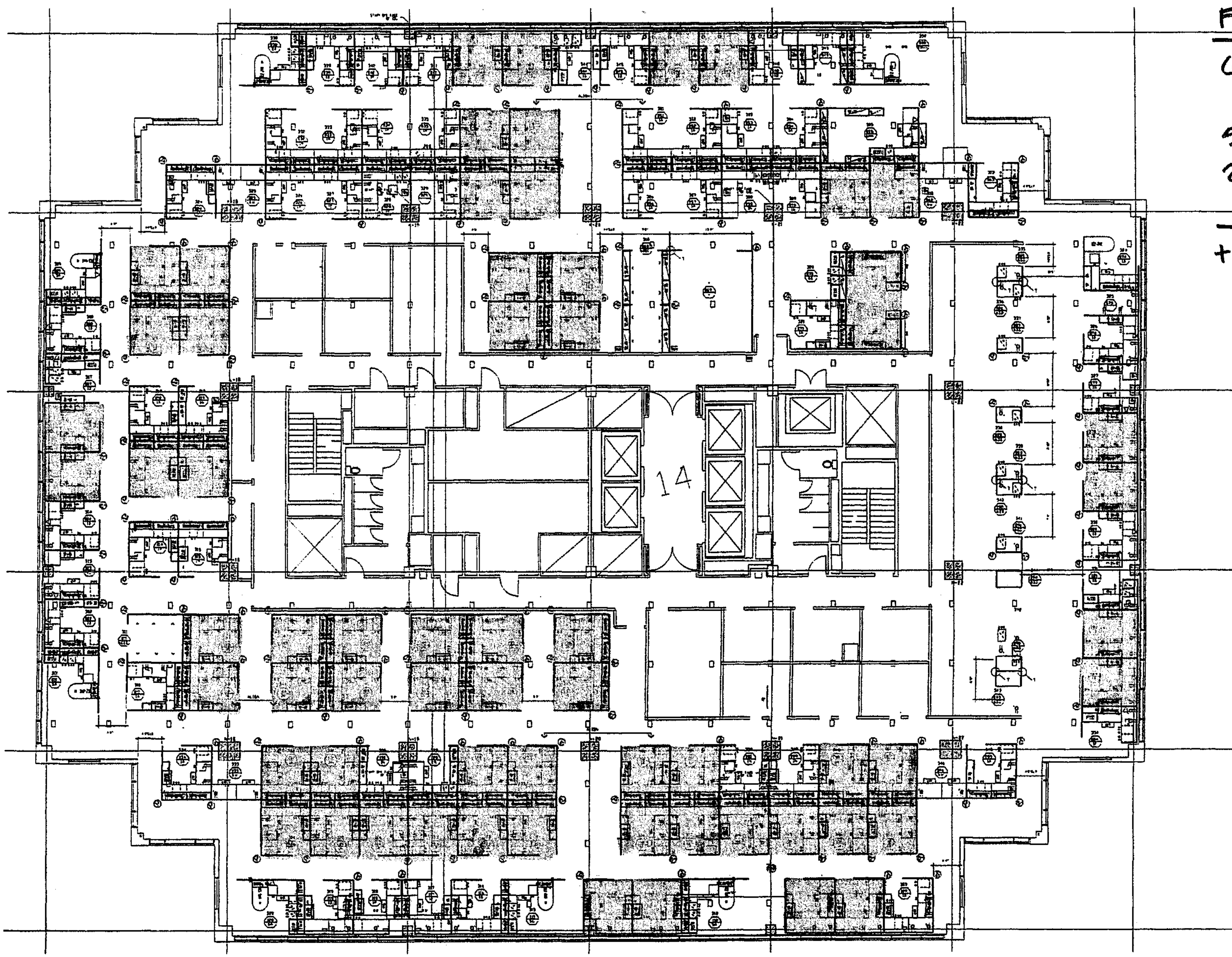
+40 W.S.



OPTION #1
FLOOR 10

84 (E) @ 72 ¢
CONVERT TO
76 (N) @ 54
38 (N) @ 36
4 (SUPV.) @ 144

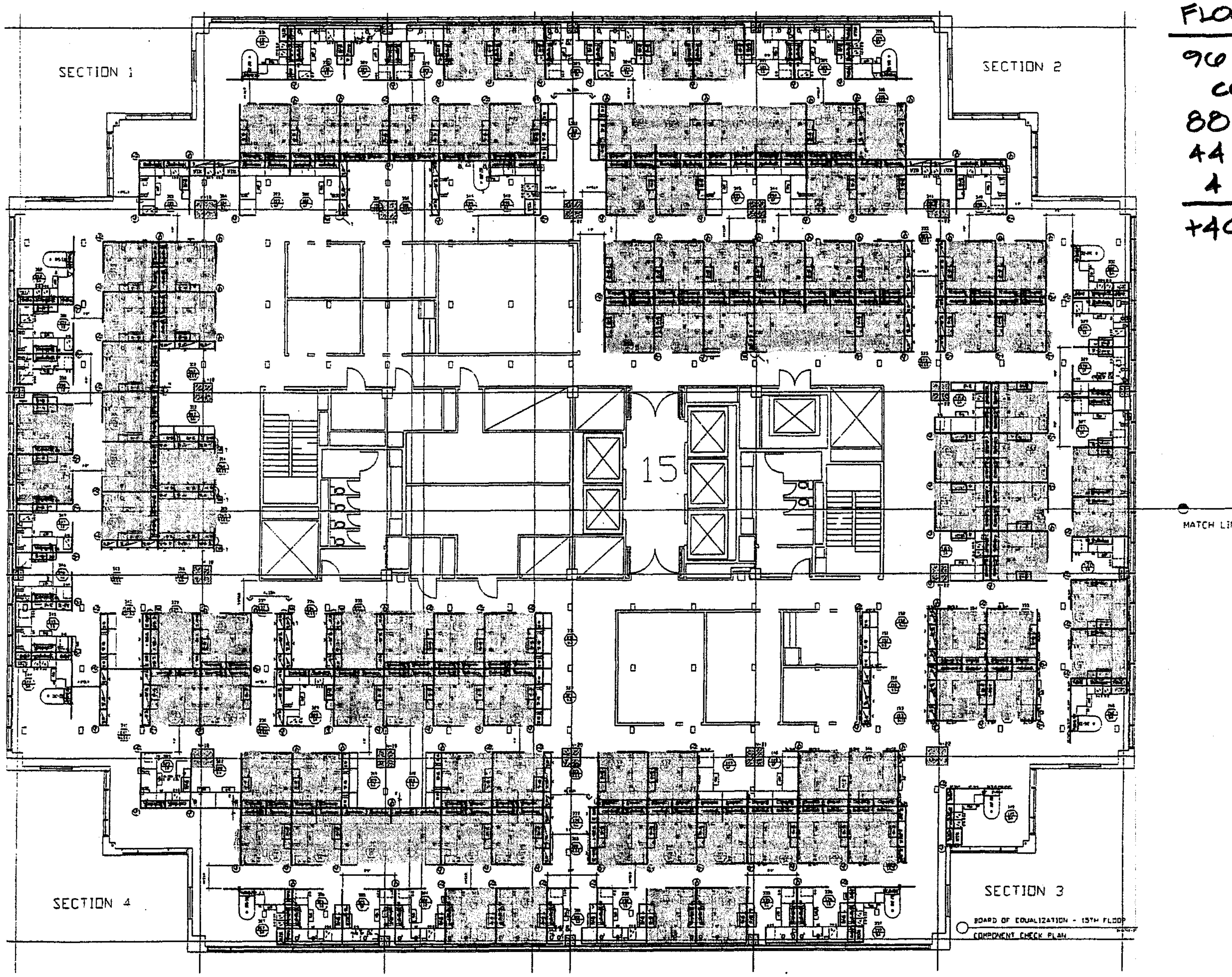
+34 W.S.



OPTION #1
FLOOR 14

64 (E) @ 72 ф
CONVERT TO
58 (N) @ 54
29 (N) @ 36
3 (SUPV.) @ 144

+26 W.S.



OPTION #1
FLOOR 15

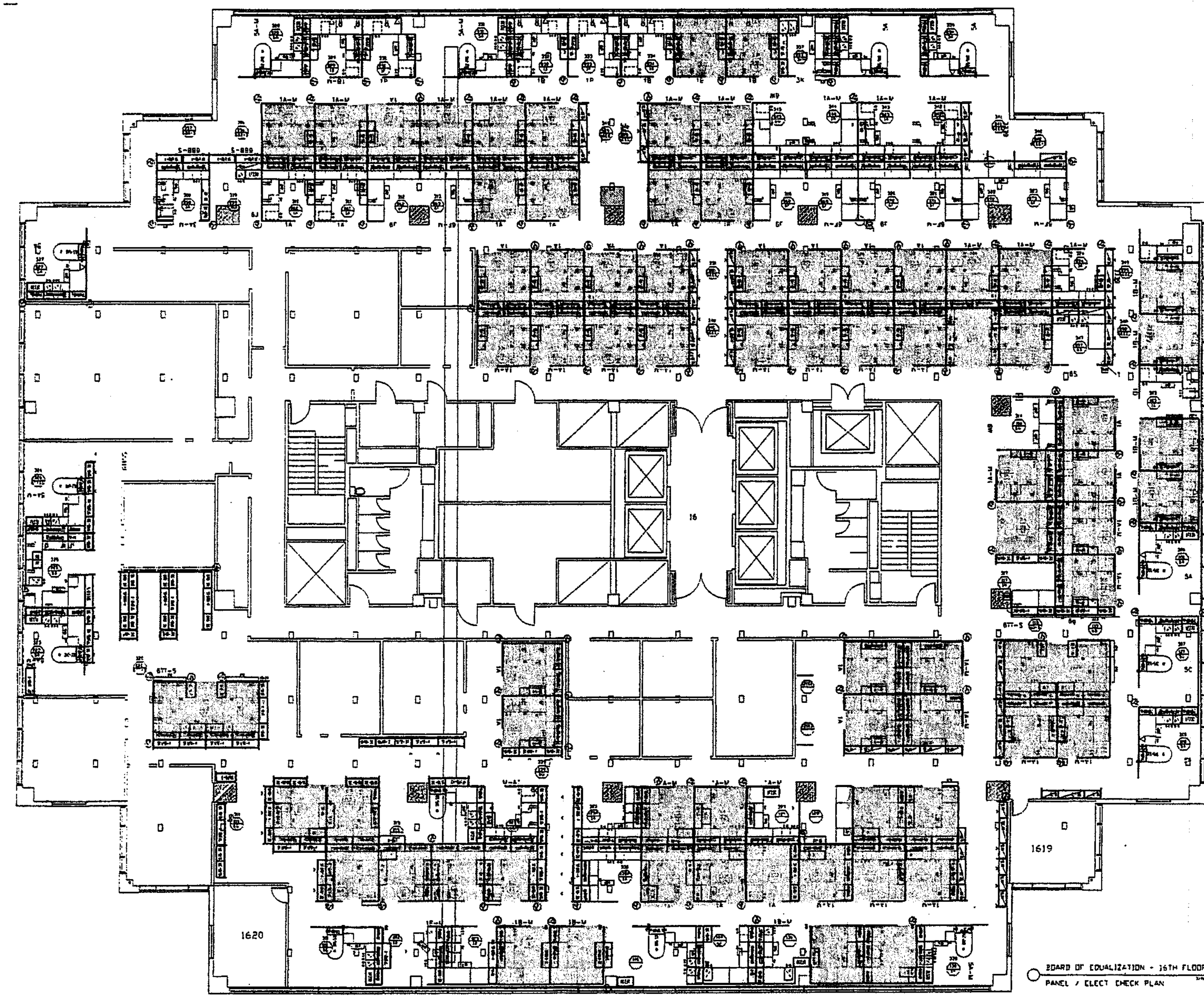
96 (E) @ 72 #
CONVERT TO
88 (N) @ 54
44 (N) @ 36
4 (SUN.) @ 144

+40 W.S.

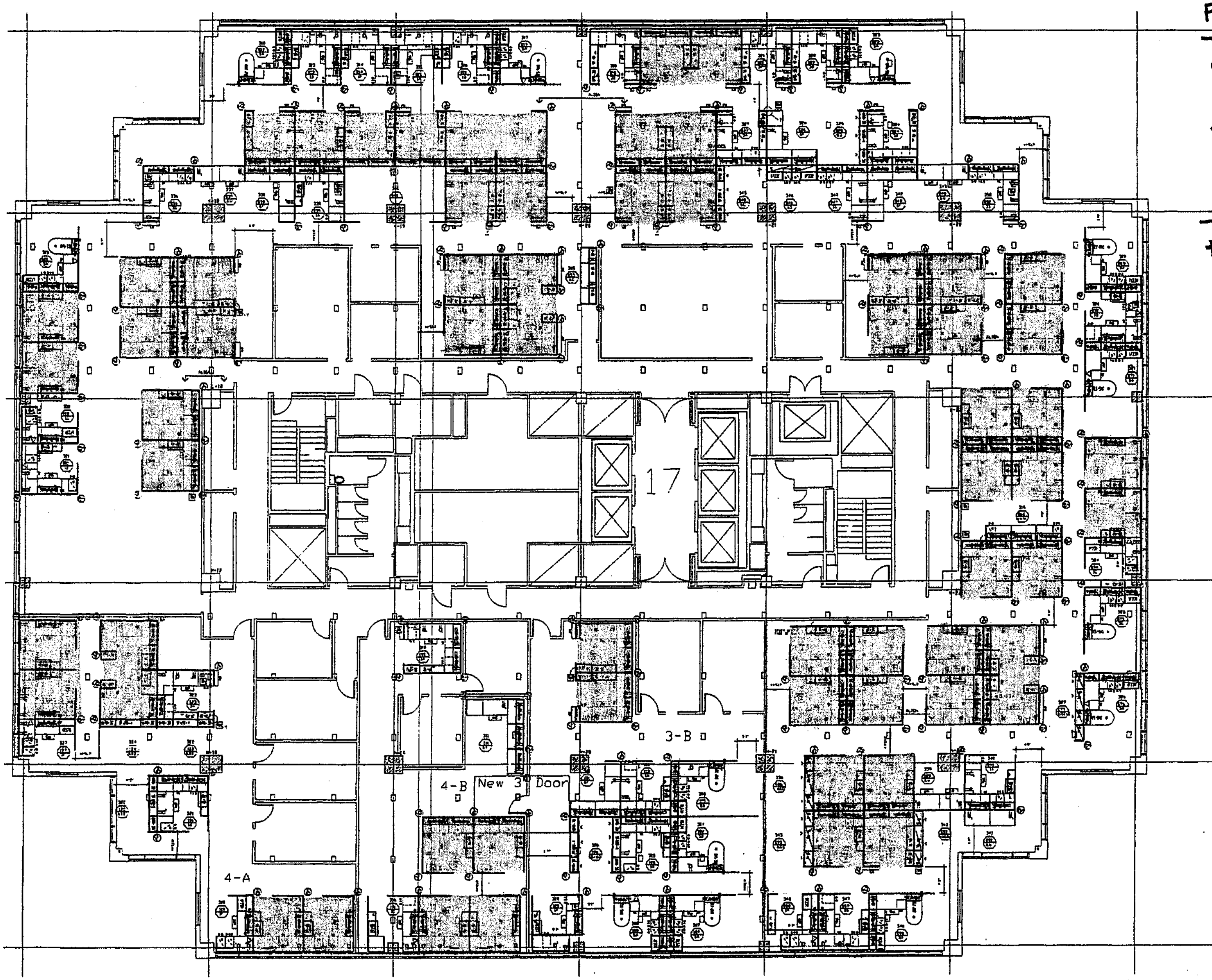
OPTION #1
FLOOR 16

76 (E) @ 72 #
CONVERT TO
68 (N) @ 54
34 (N) @ 36
4 (SUPV.) @ 144

+30 W.S.



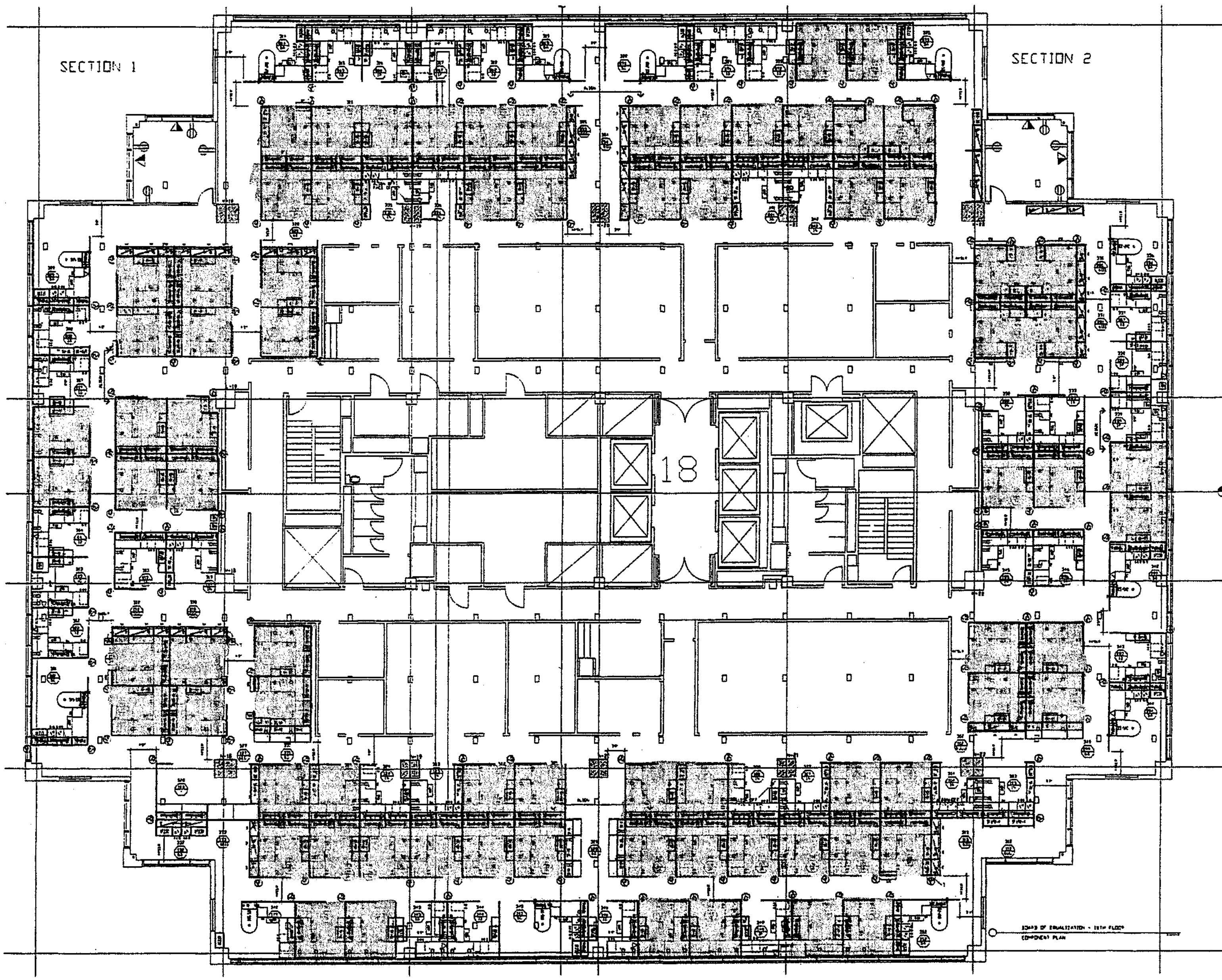
BOARD OF EQUALIZATION - 16TH FLOOR
PANEL / ELECT CHECK PLAN



OPTION #1
FLOOR 17

64 (E) @ 72 ℄
CONVERT TO
38 (N) @ 54 ℄
29 (N) @ 36
3 (SUN.) @ 144

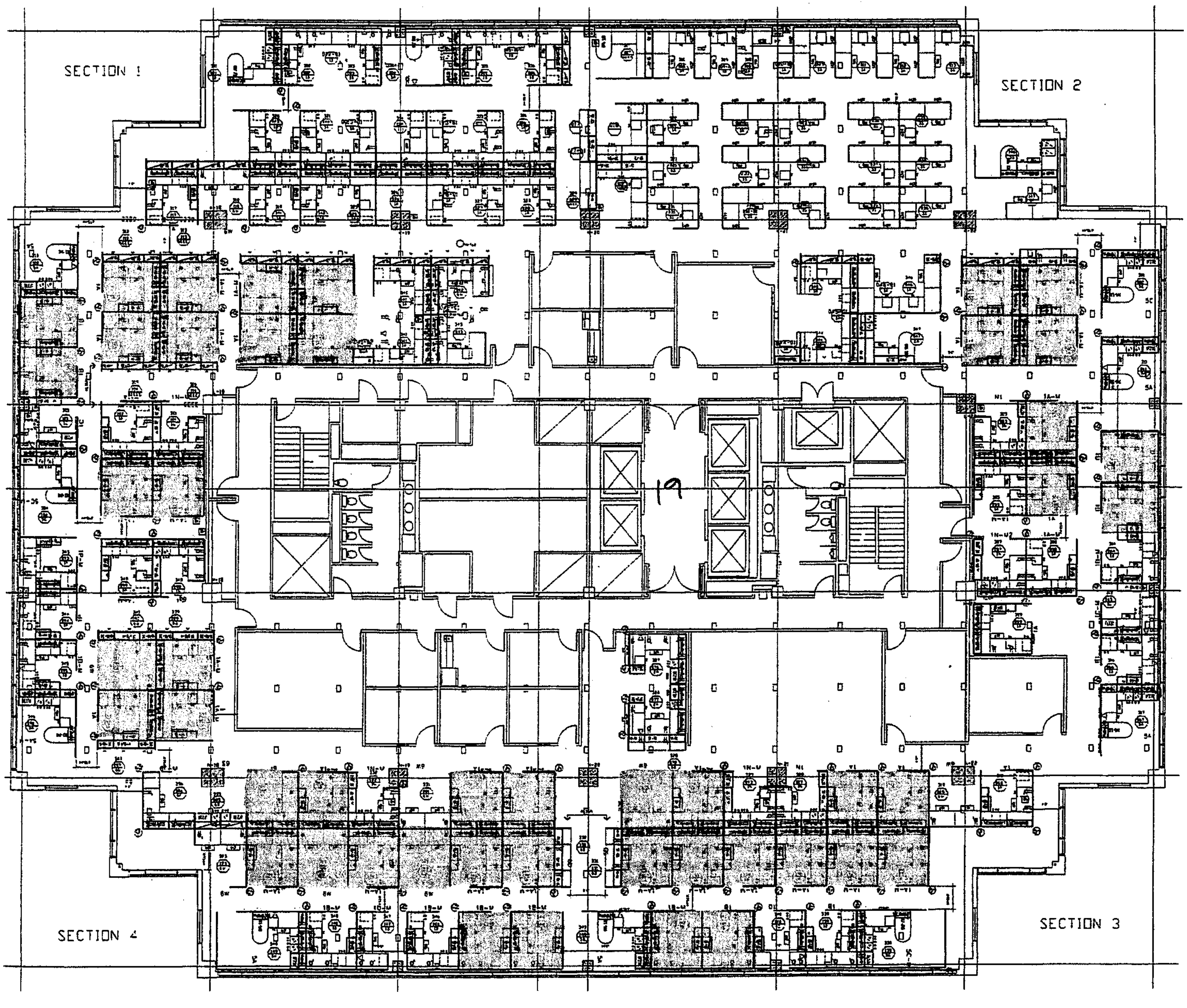
+26 W.S.



OPTION #1
FLOOR 18

76 (E) @ 72 ф
CONVERT TO
70 (N) @ 54
35 (N) @ 36
3 (SUPV.) @ 144

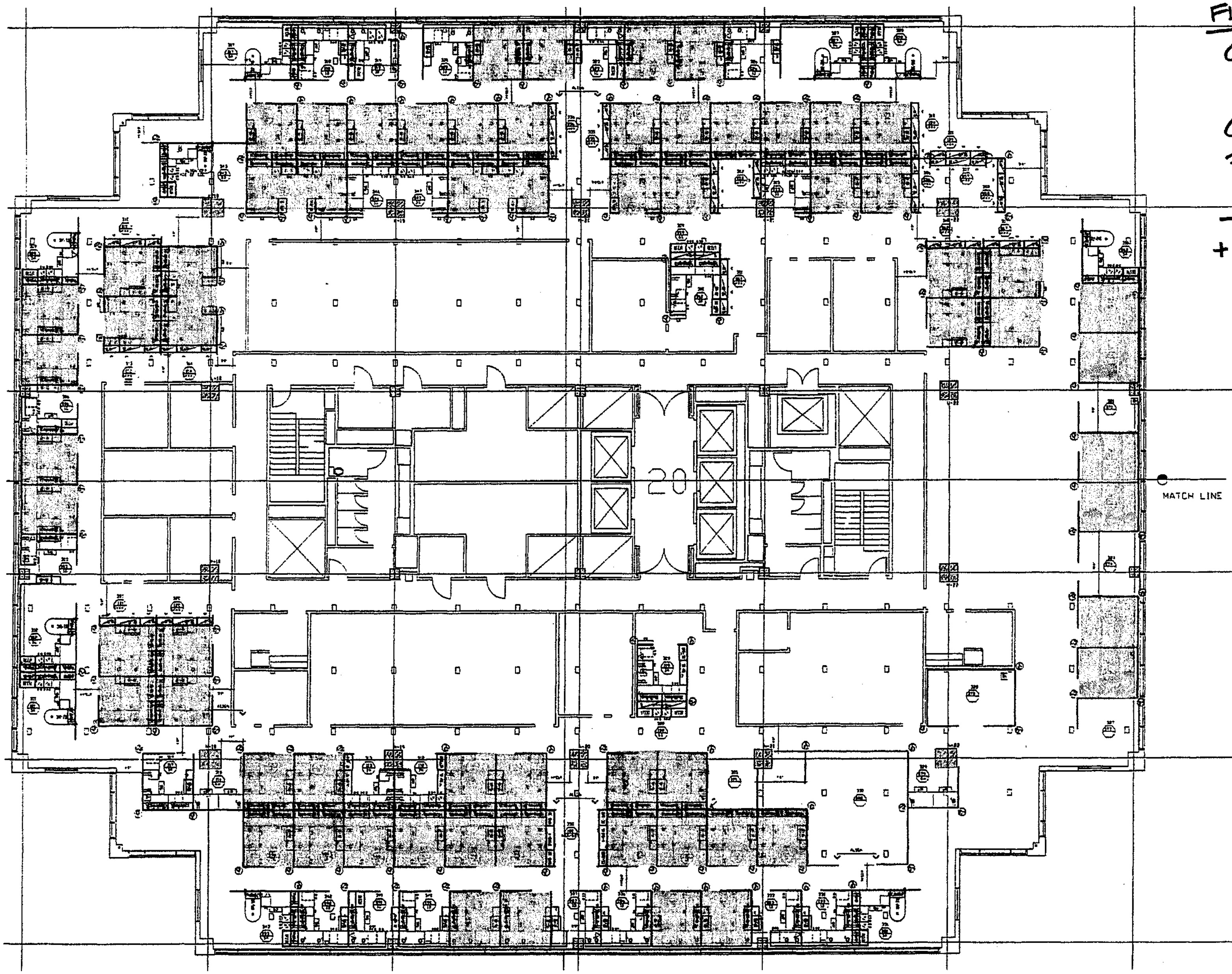
+32 W.S.



OPTION #1
FLOOR 19

48 (E) @ 72 ¢
CONVERT TO
44 (N) @ 54
22 (N) @ 36
2 (SUN.) @ 144

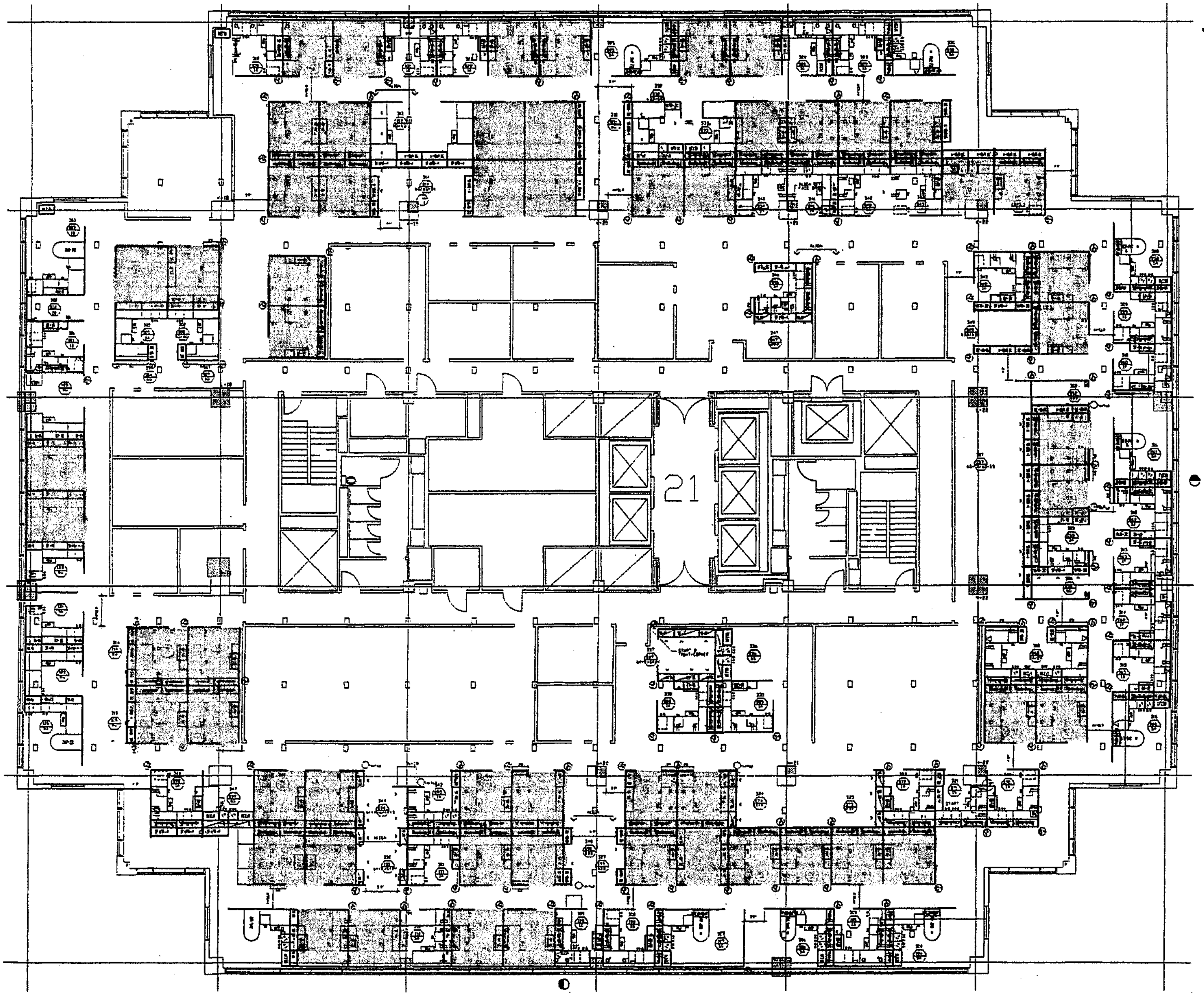
+20 W.S.



OPTION #1
FLOOR 20

66 (E) @ 72 #
CONVERT TO
60 (N) @ 54
30 (N) @ 36
3 (SUPV.) @ 144

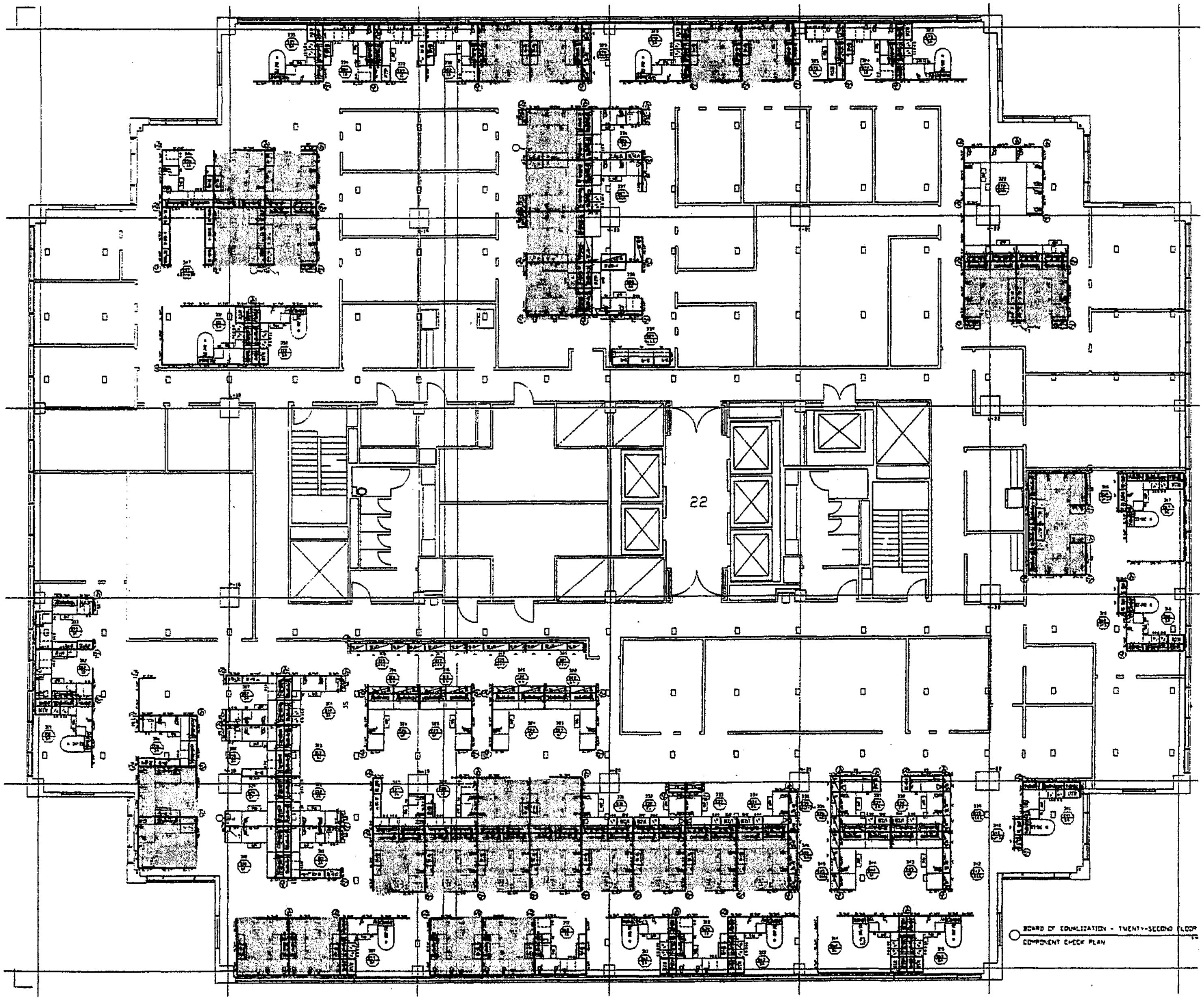
+27 W.S.



OPTION # 1
FLOOR 21

58 (E) @ 72 ф
CONVERT TO
52 (N) @ 54
26 (N) @ 36
3 (SUPV.) @ 144

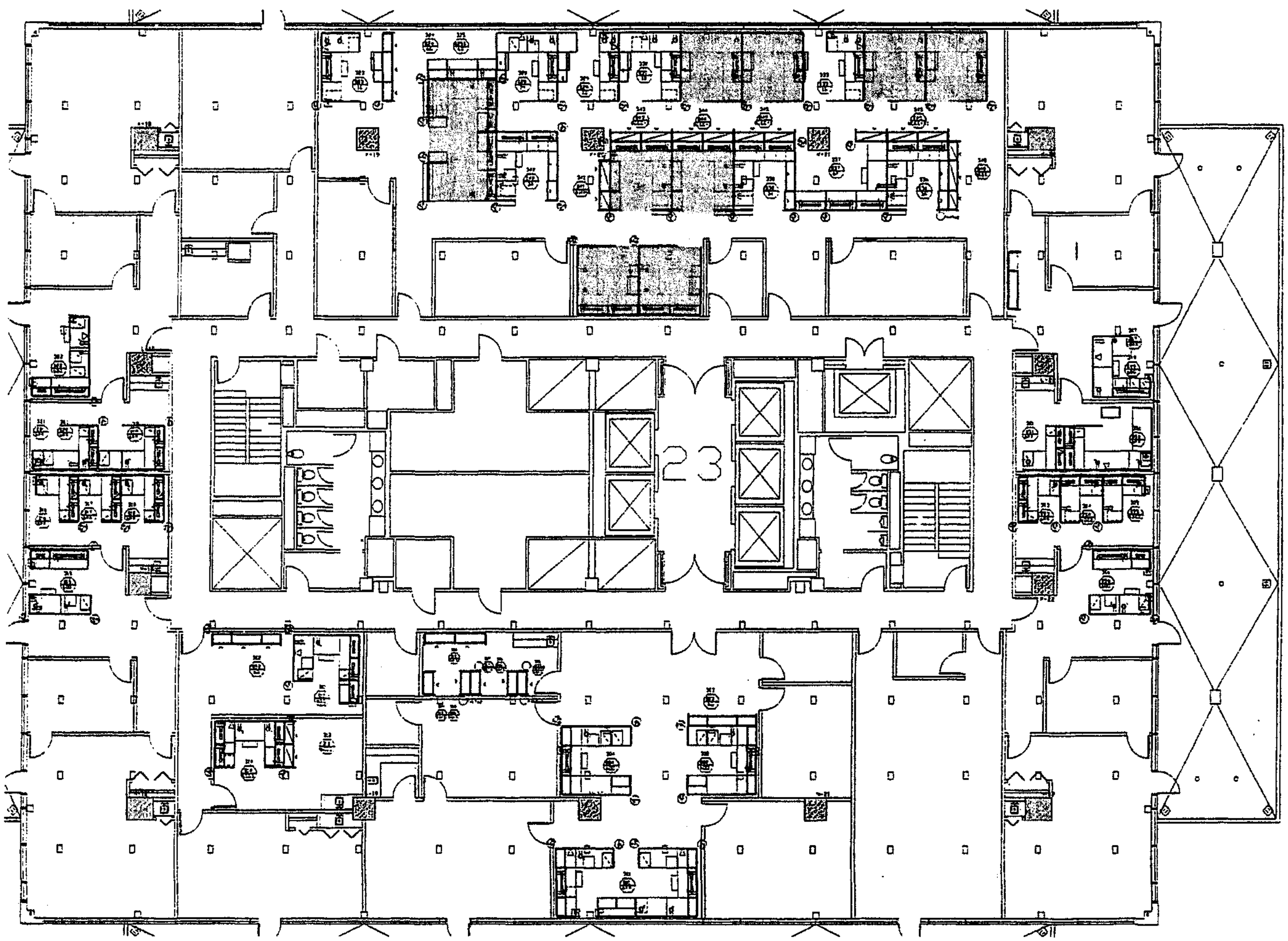
+23 W.S.



OPTION # 1
FLOOR 22

28 (E) @ 72 ф
CONVERT TO
26 (N) @ 54
13 (N) @ 36
1 (SUP.) @ 144

+12 W.S.



OPTION #1
FLOOR 23

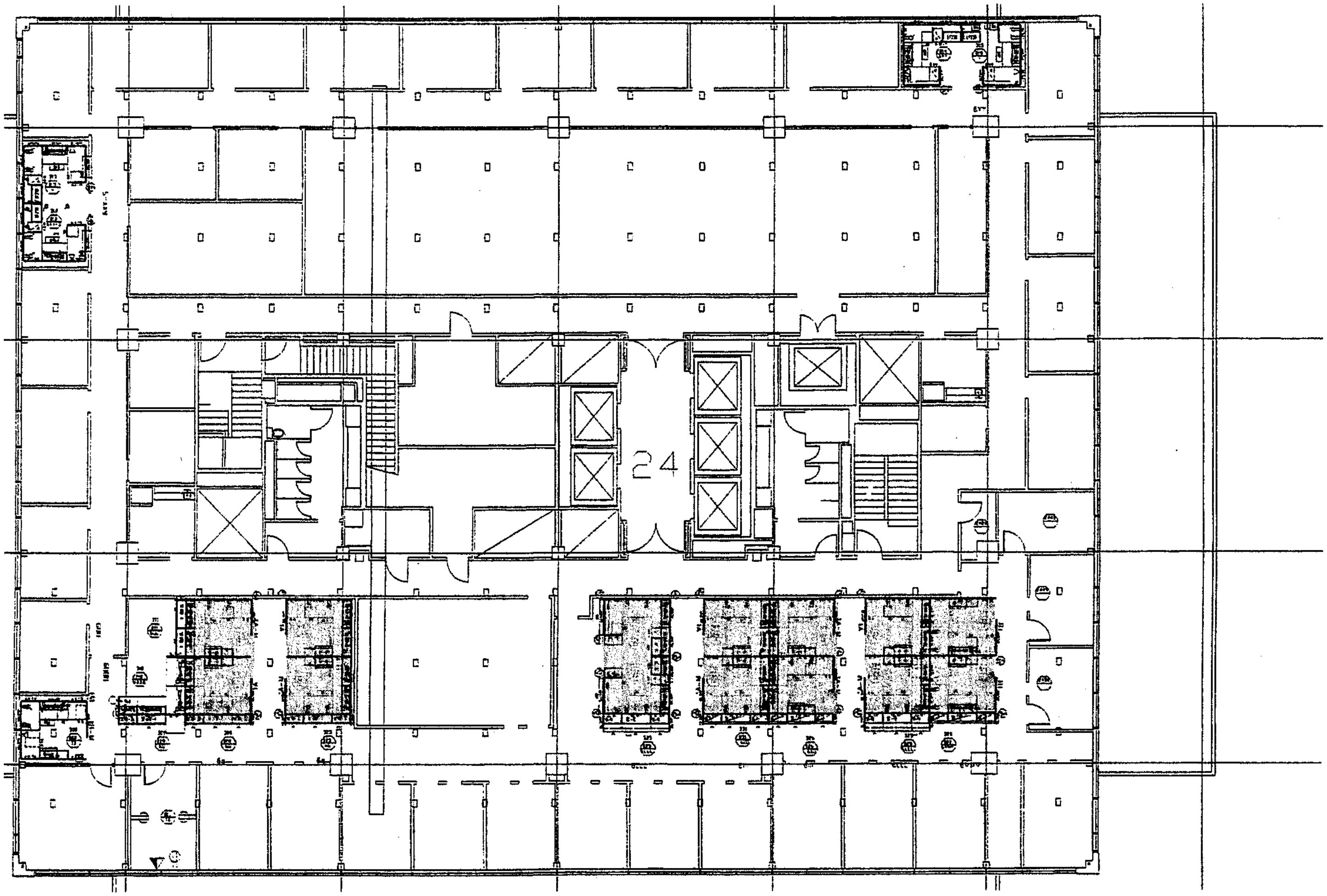
10 (E) @ 72 ф
CONVERT TO
10 (N) @ 54
5 (N) @ 36

+5 W.S.

OPTION #1
FLOOR 24

14 (E) @ 72 ¢
CONVERT TO
14 (N) @ 54
7 (N) @ 30

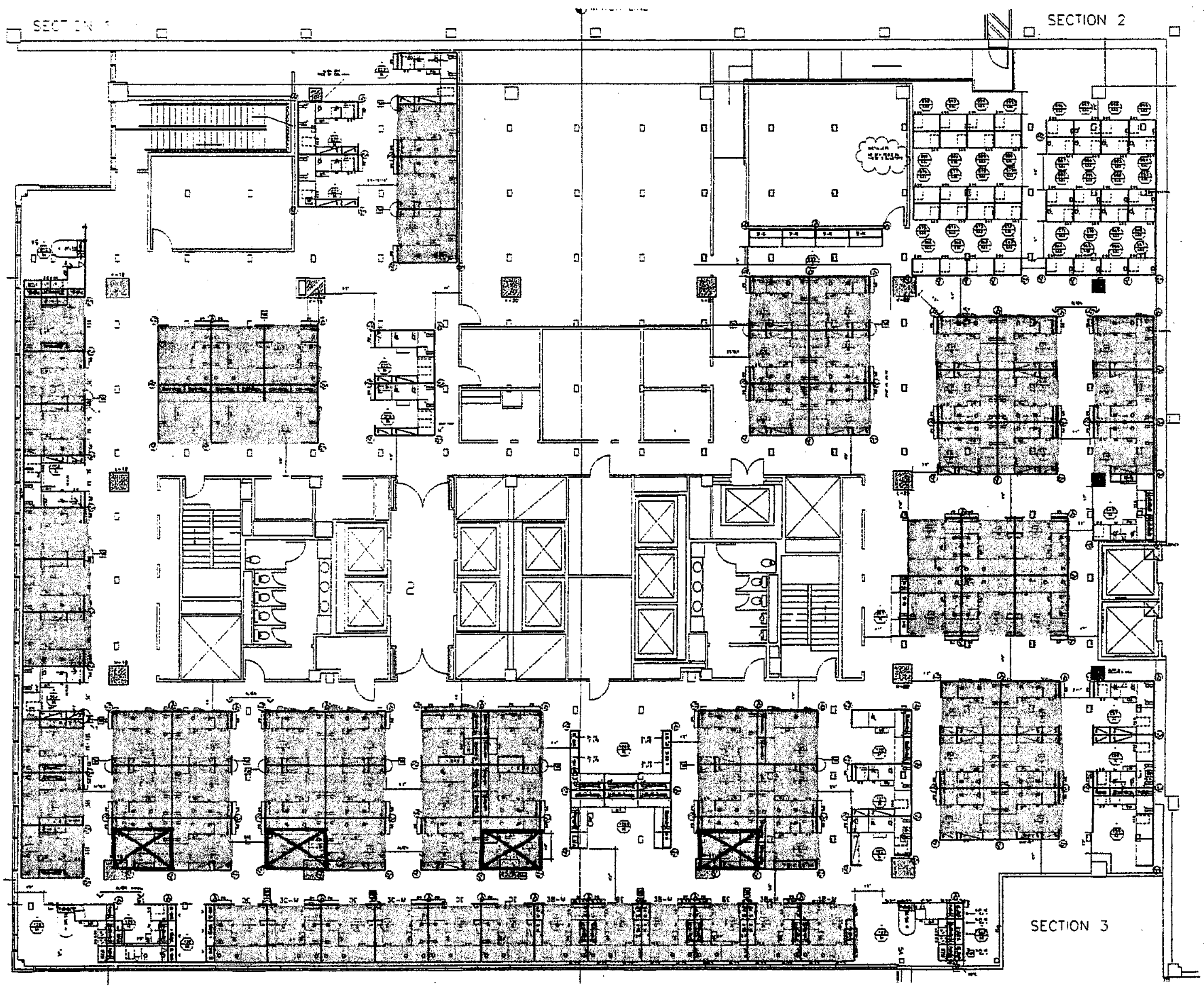
+7 W.S.



OPTION #2
FLOOR 2

81 (E) @ 72 ¢
CONVERT TO
104 (N) @ 54 ¢

+ 23 W.S.



WESTERN CONTRACT FURNISHERS

WCF DESIGN GROUP

PROPRIETARY NOTE

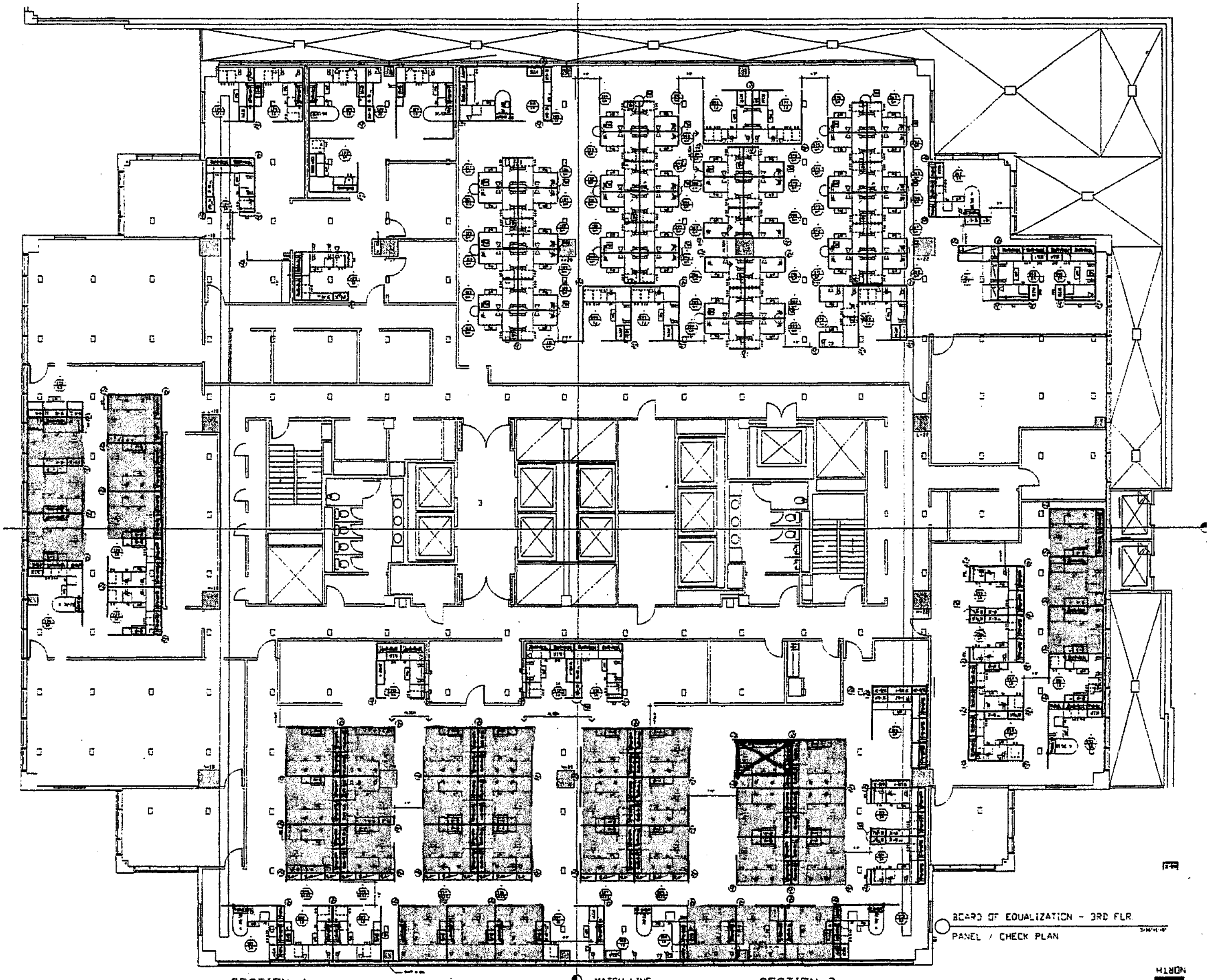
BD. OF EQUALIZATION
450 N ST., 2ND FLR.
SACRAMENTO, CA

FINAL

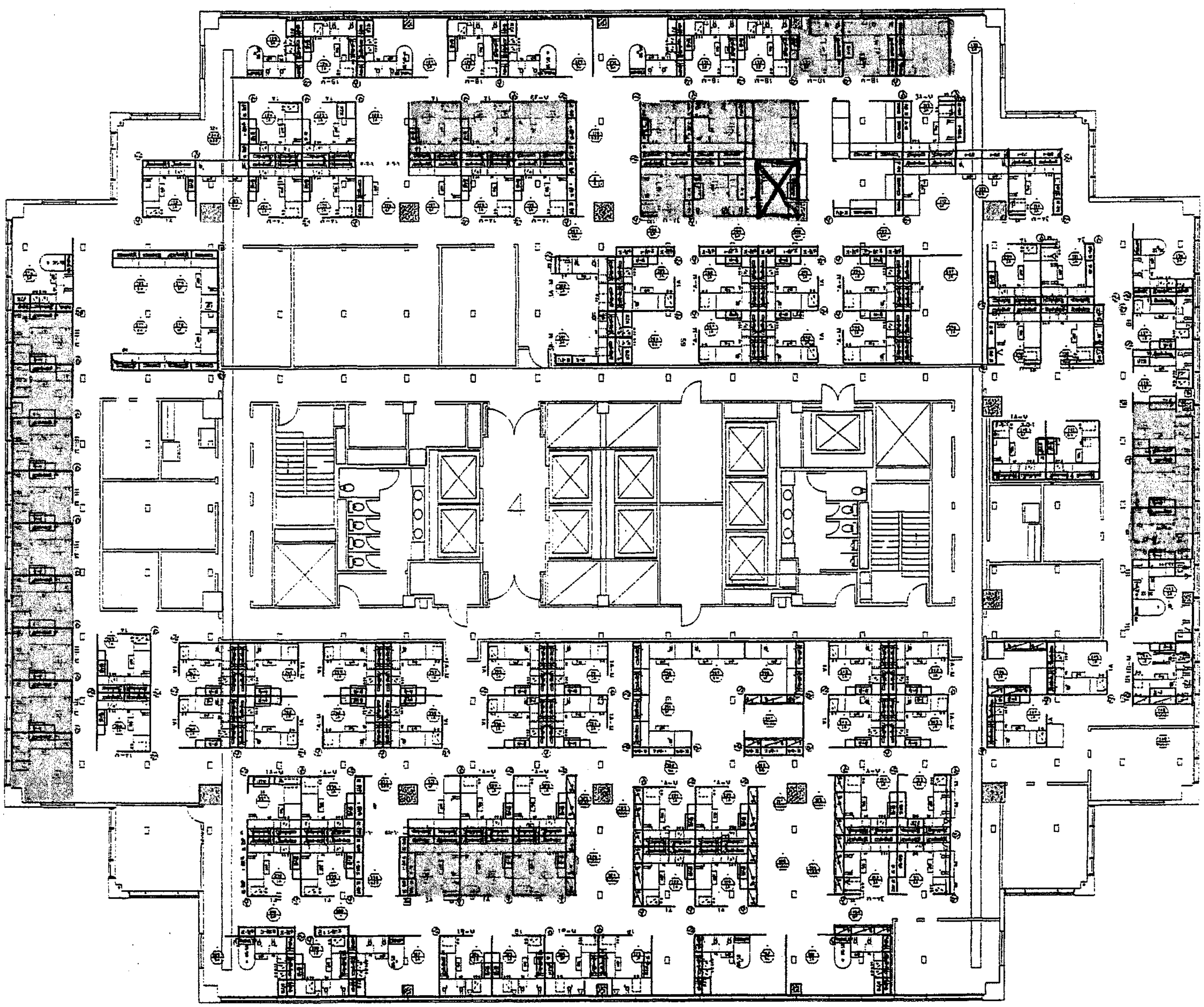
OPTION #2
FLOOR 3

39 (E) @ 72 ɸ
CONVERT TO
52 (N) @ 54 ɸ

+13 W.S.



BOARD OF EQUALIZATION - THIRD FLR.



OPTION #2
FLOOR 4

27 (E) @ 72 ¢
CONVERT TO
35 (N) @ 54 ¢

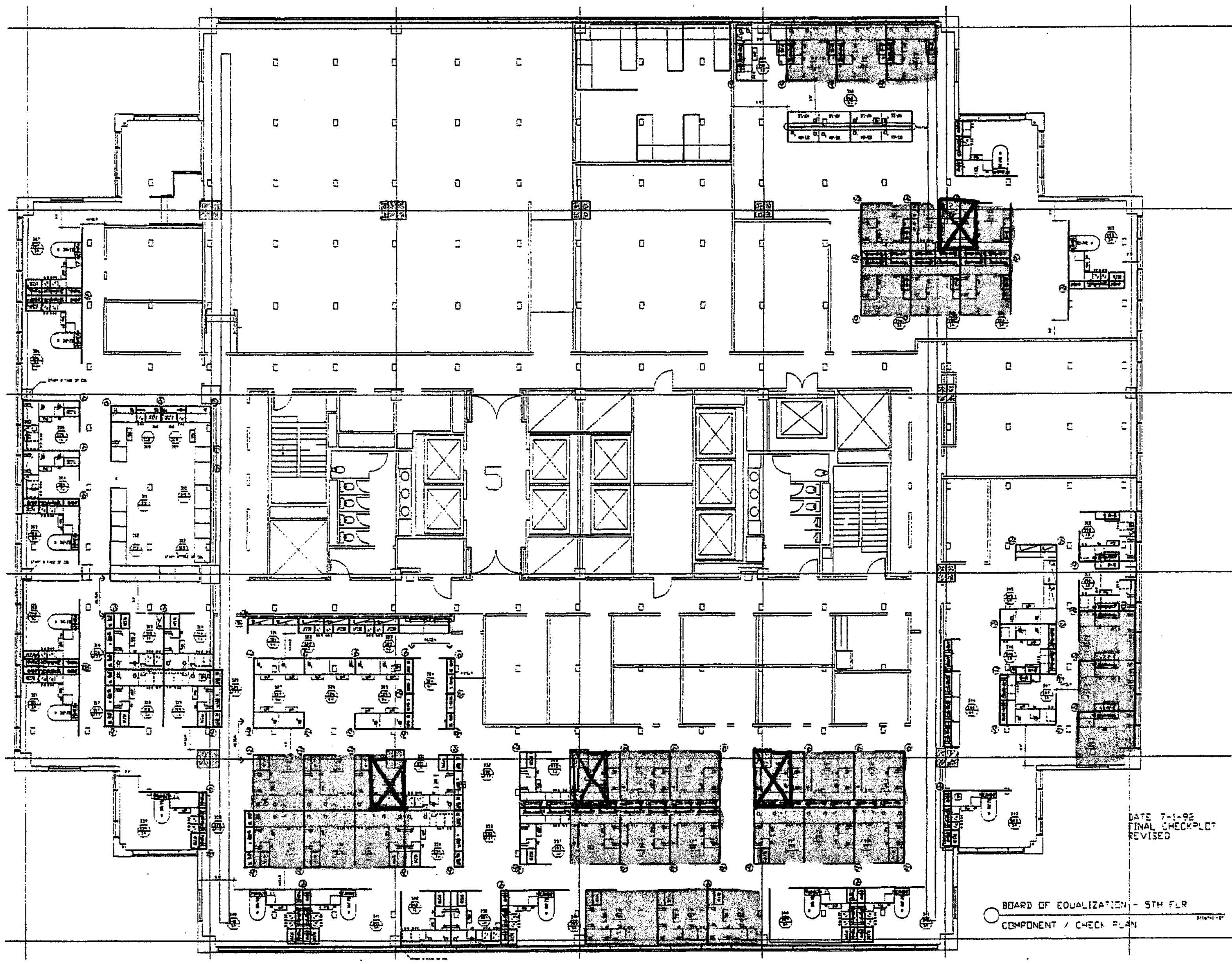
+8 W.S.

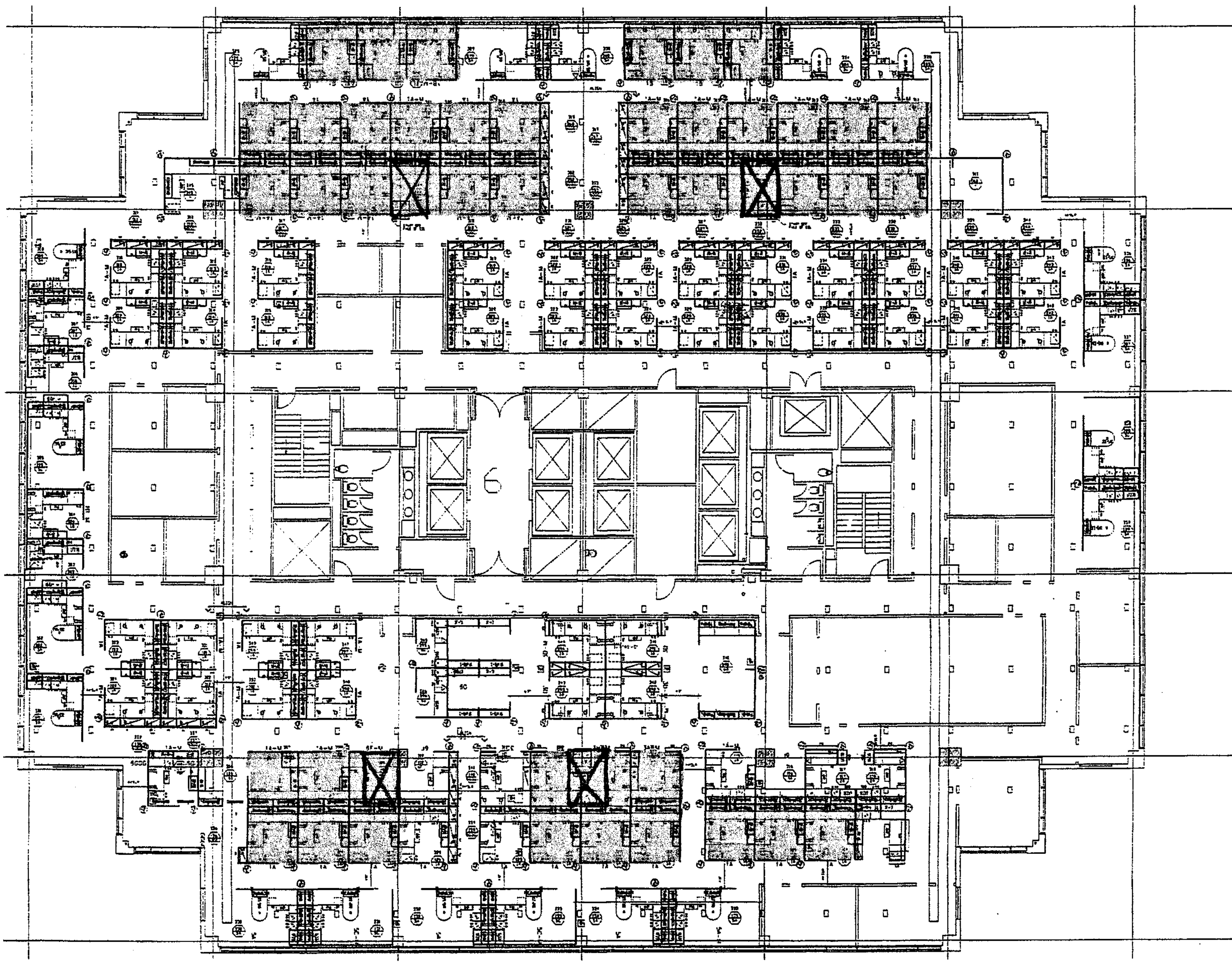
OPTION #2

FLOOR 5

33 (E) @ 72 ¢
CONVERT TO
40 (N) @ 54 ¢

+7 W.S.





CHECKED BY

FILENAME ST

OPTION # 2

FLOOR 6

45 (E) @ 72 ¢

CONVERT TO

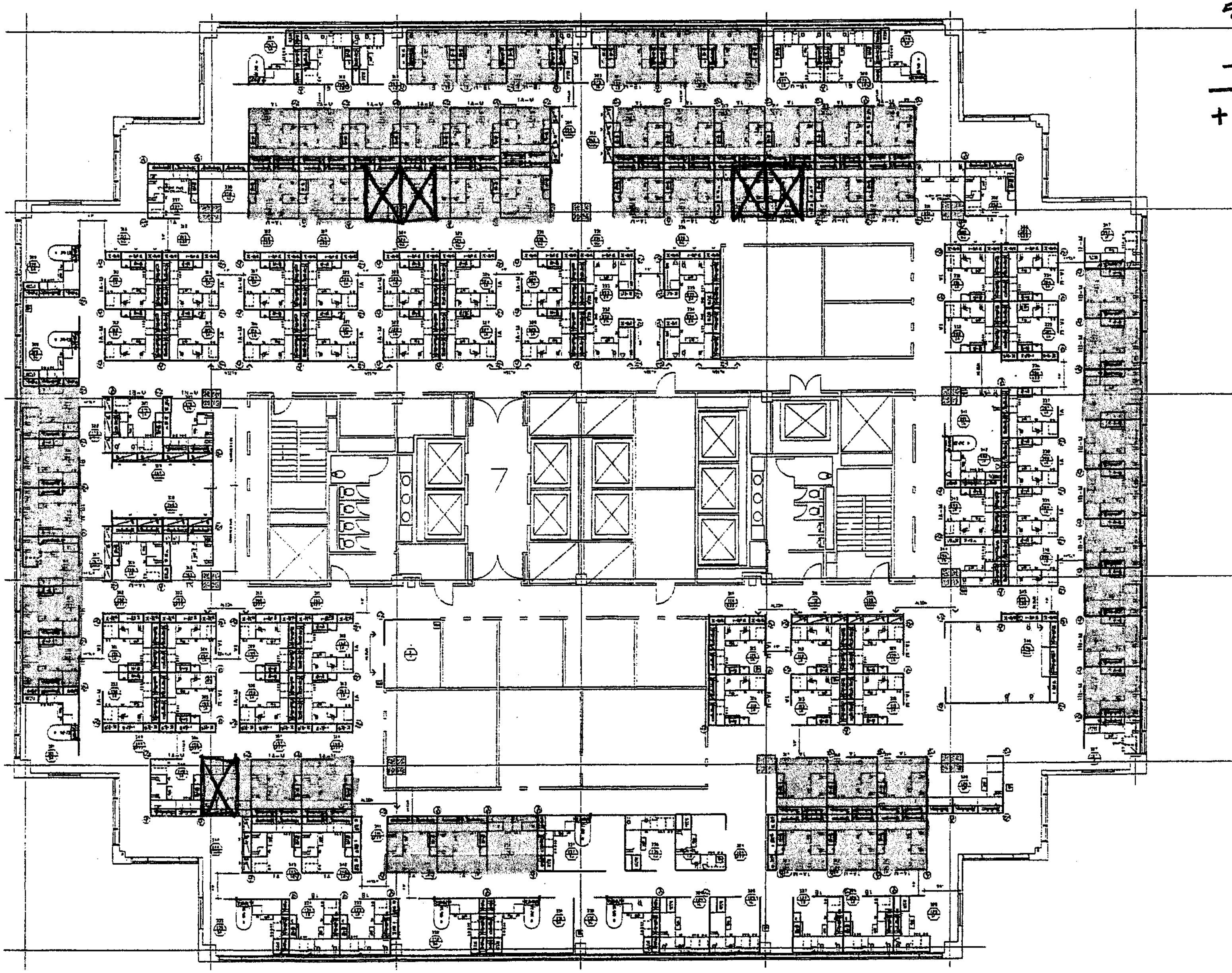
56 (N) @ 54 ¢

+11 W.S.

OPTION #2
FLOOR 7

57 (E) @ 72 ¢
CONVERT TO
71 (N) @ 54 ¢

+14 W.S.



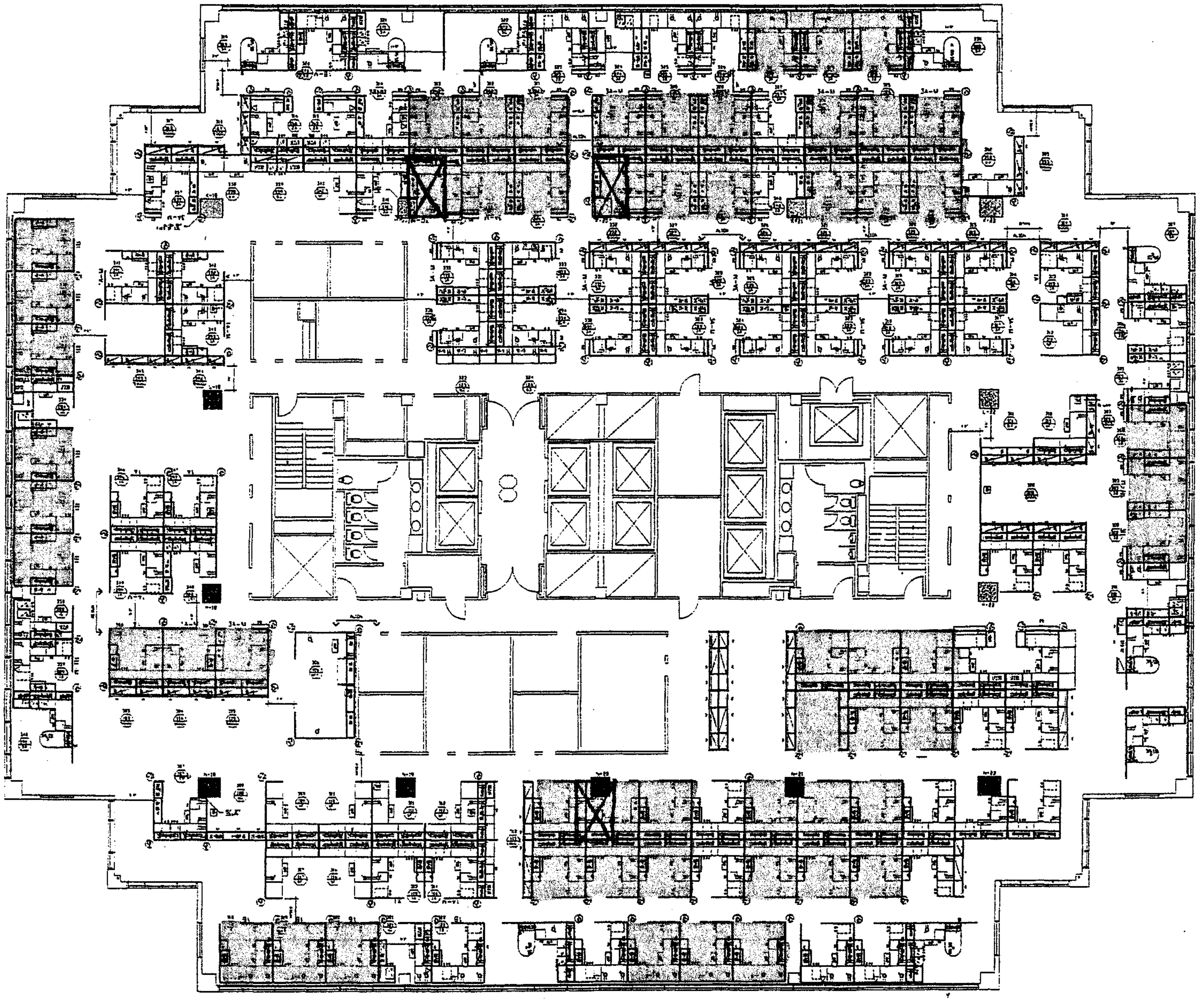
GENERAL NOTES

HAWORTH KEY #
STATION NUMBER
TYPICAL

NOTE
INSIDE CLEAR DIMENSIONS FOR EACH AREA A
ANY DISCREPANCY IN ACTUAL FIELD DIMENSI
BE CRITICAL AND CAUSE PLANS AND PRODUC
TO CHANGE ... MUST BE NOTIFIED

ELECTRICAL NOTES

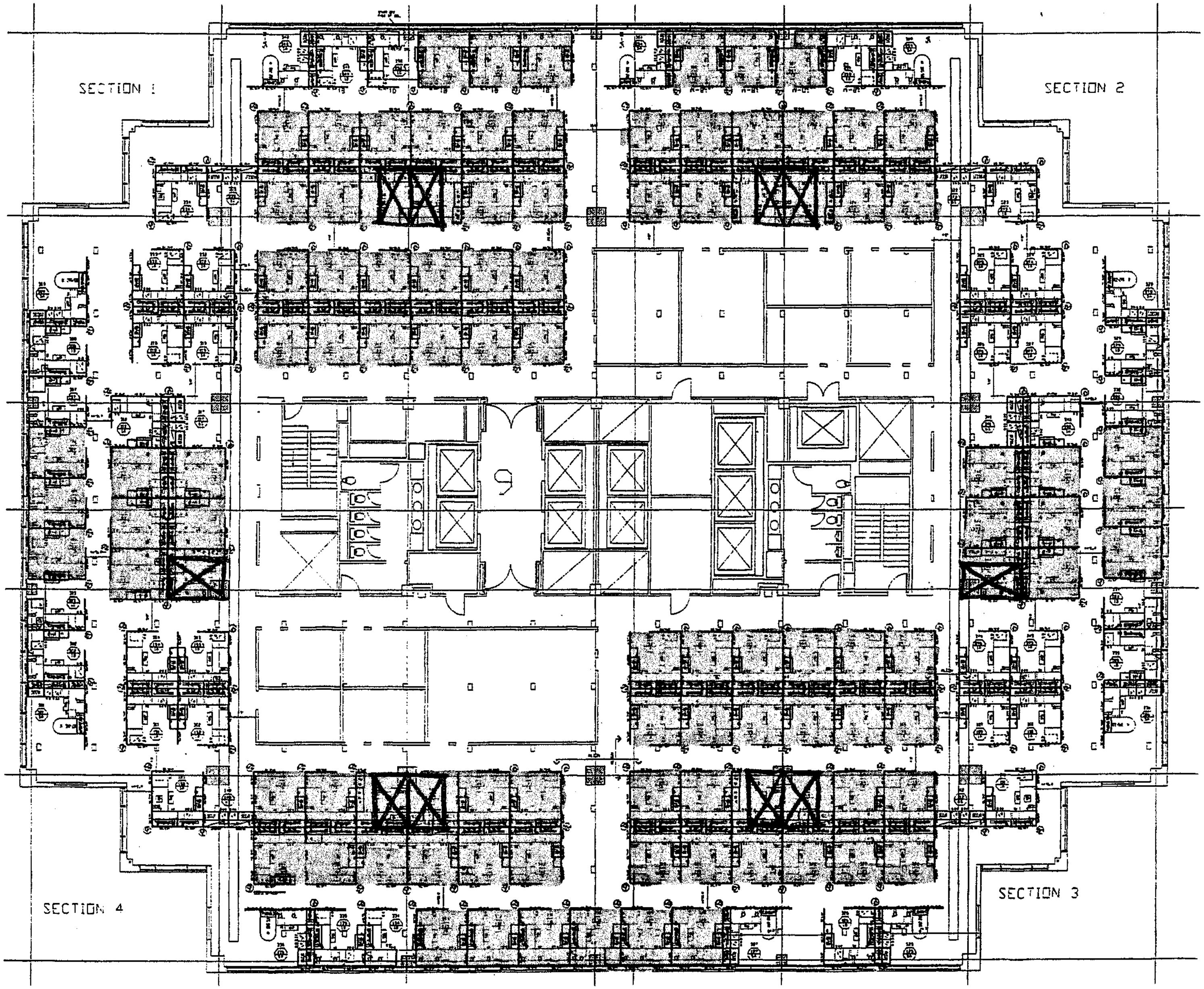
LEGEND



OPTION #2
FLOOR 8

57 (E) @ 72 ¢
CONVERT TO
73 (N) @ 54 ¢

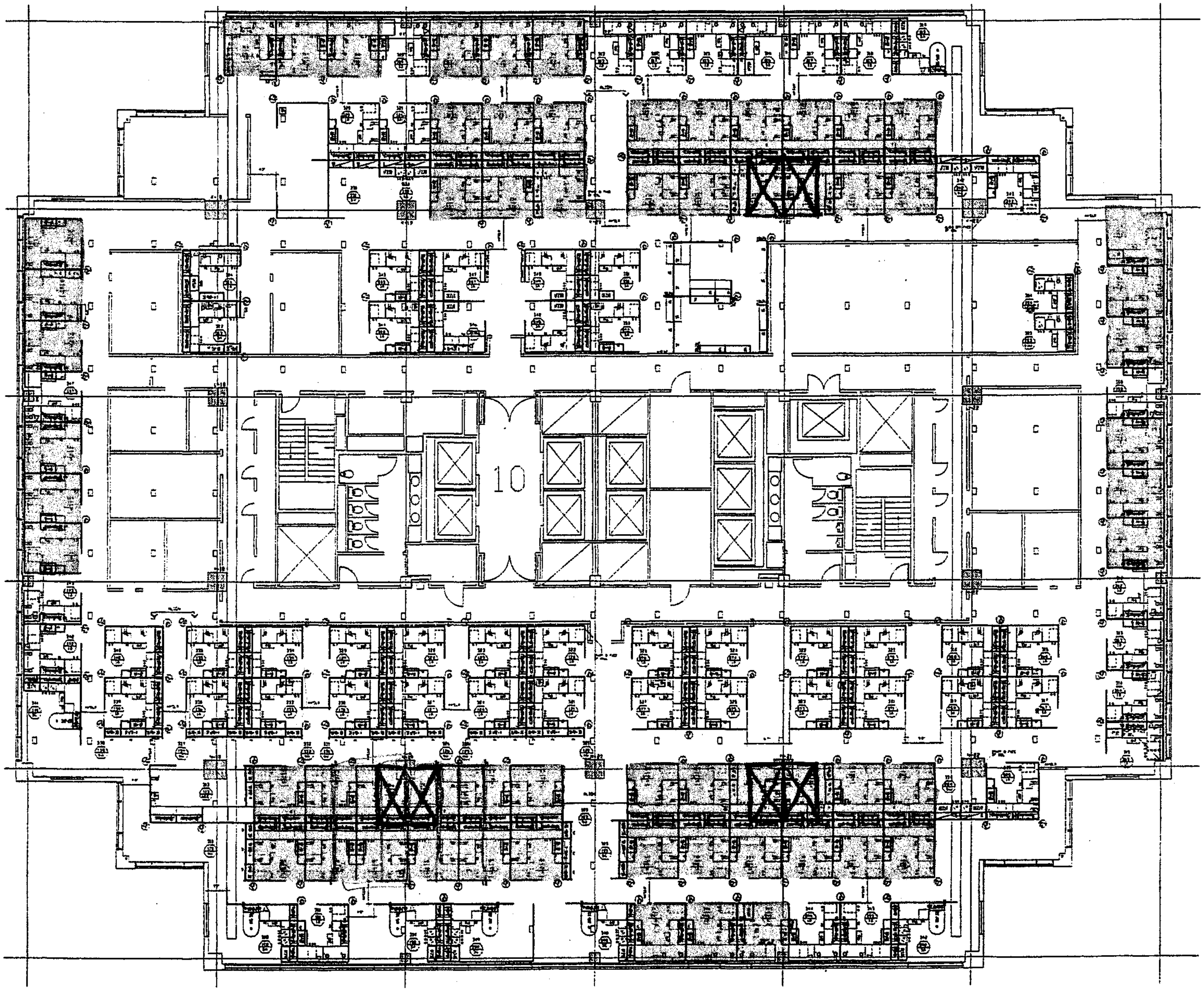
+16 W.S.



OPTION #2
FLOOR 9

102 (E) @ 72¢
CONVERT TO
126 (N) @ 54¢

+24 W.S.

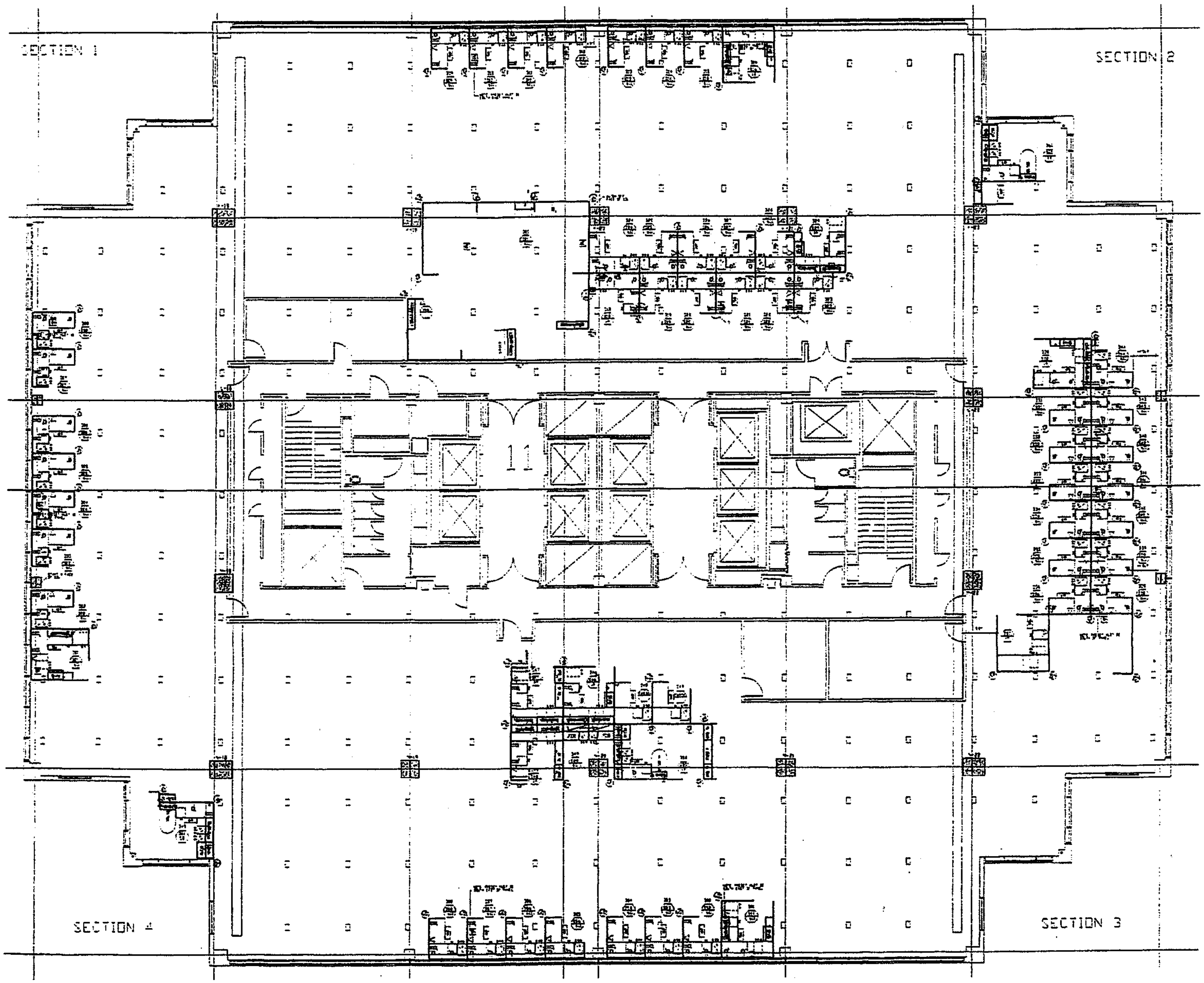


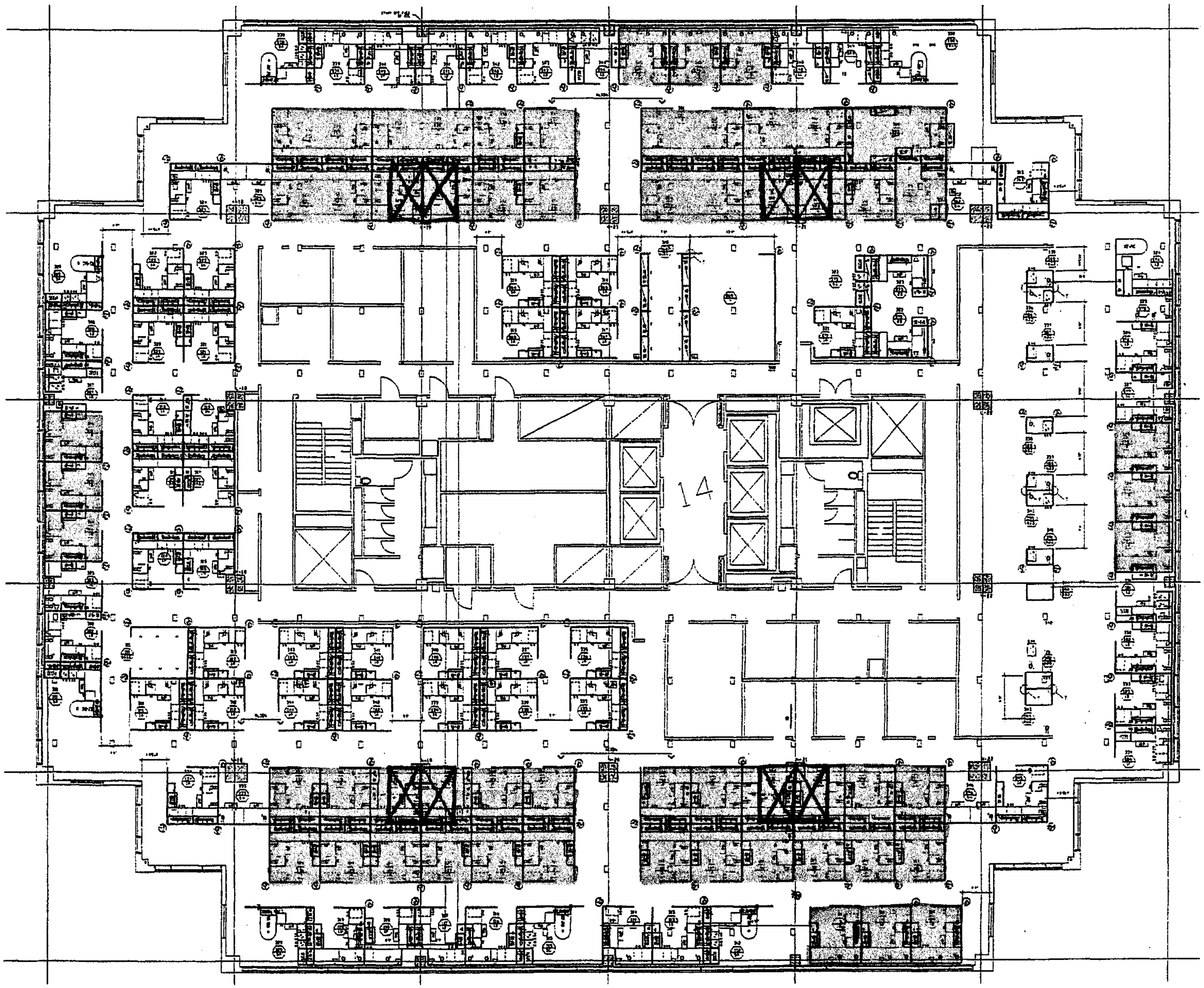
OPTION #2
FLOOR 10

63 (E) @ 72 ¢
CONVERT TO
78 (N) @ 54 ¢

+15 W.S.

FLOOR 11

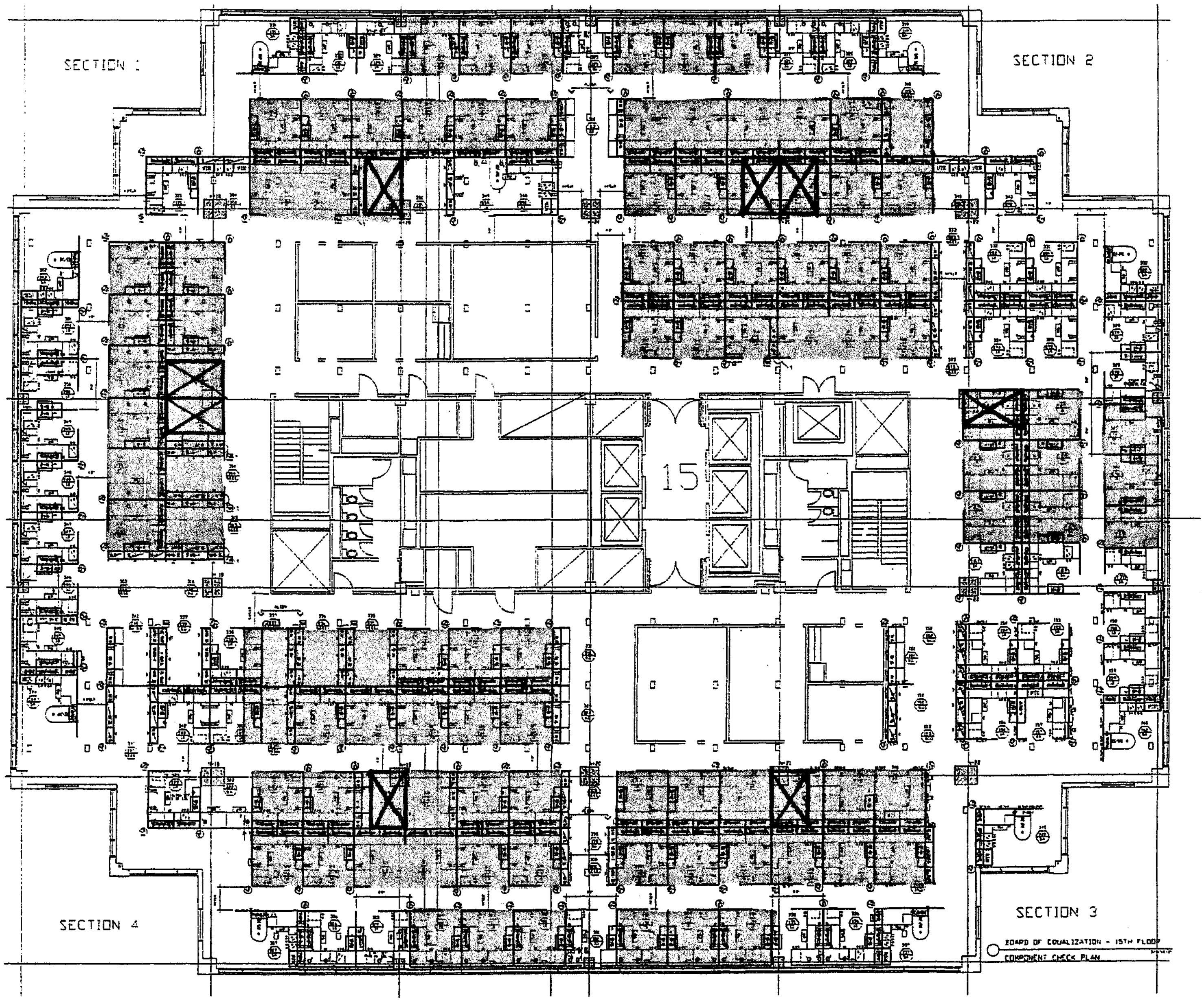




OPTION #2
FLOOR 14

42 (E) @ 72 ¢
24 (E) @ 48 ¢
CONVERT TO
72 (N) @ 54 ¢

+6 W.S.



OPTION # 2
FLOOR 15

93 (E) @ 72 ф
9 FILE AREAS
CONVERT TO
128 (N) @ 54 ф

+35 W.S.

OPTION #2

FLOOR 16

58 (E) @ 72 Φ

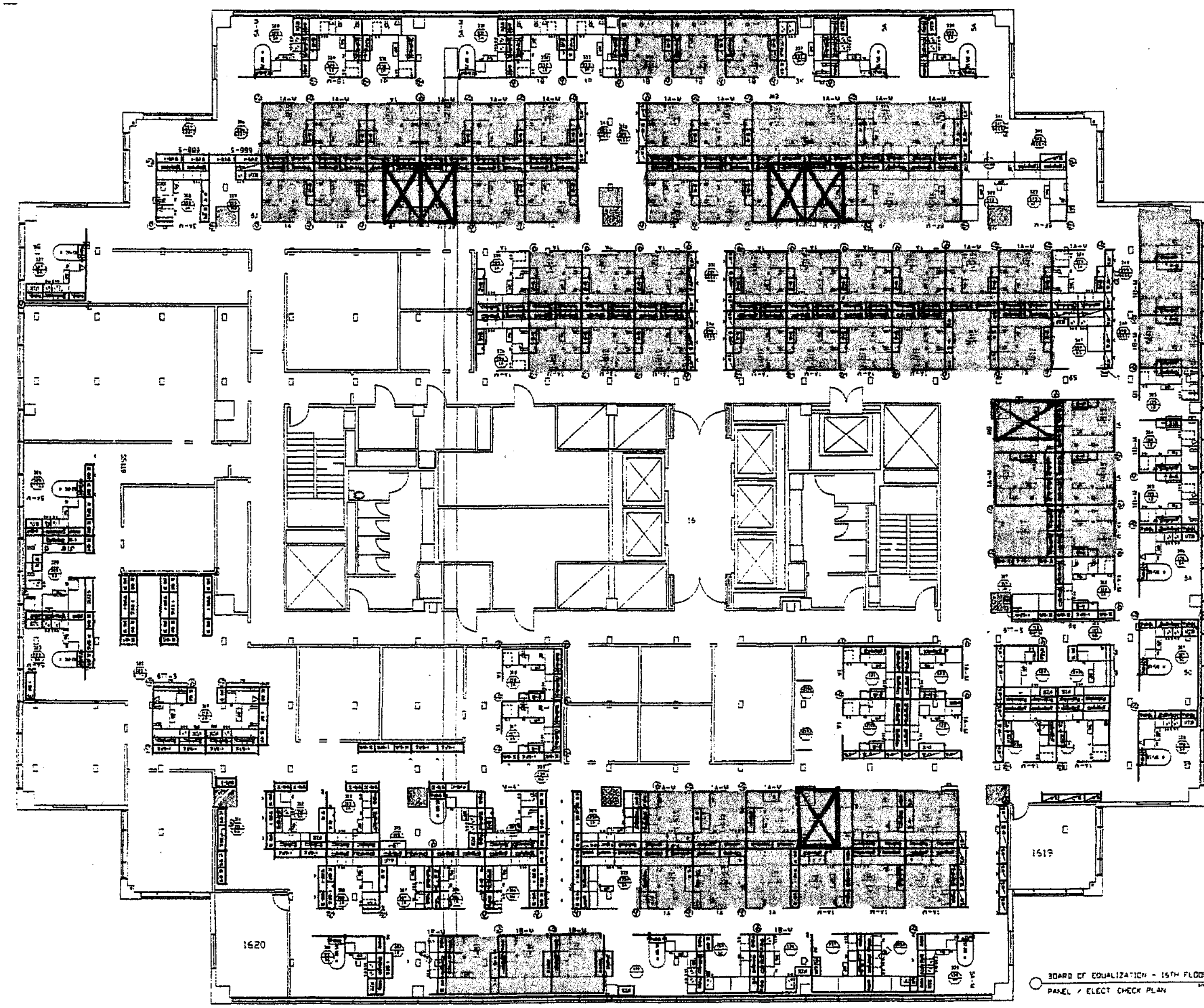
3 FILE AREAS 72 Φ

12 (E) @ 48 Φ

CONVERT TO

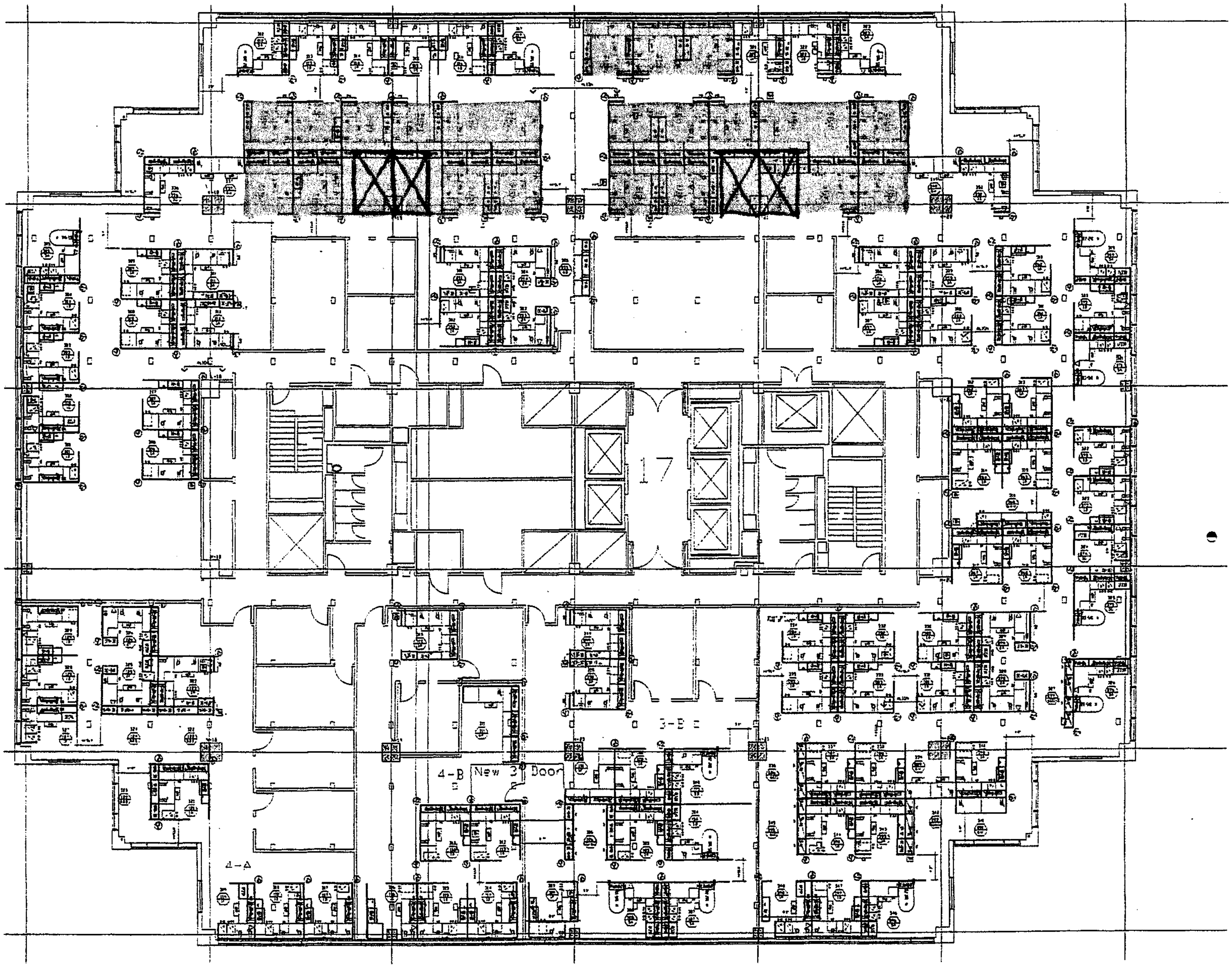
86 (N) @ 54 Φ

+16 W.S.



BOARD OF EQUALIZATION - 15TH FLOOR

PANEL / ELECT CHECK PLAN



OPTION #2
FLOOR 17

23 (E) @ 72 ¢
4 FILE AREAS
CONVERT TO
32 (N) @ 54 ¢

+9 W.S.

GENERAL NOTES

HAWORTH KEY #
301
102
T-3
STATION NUMBER
TYPICAL

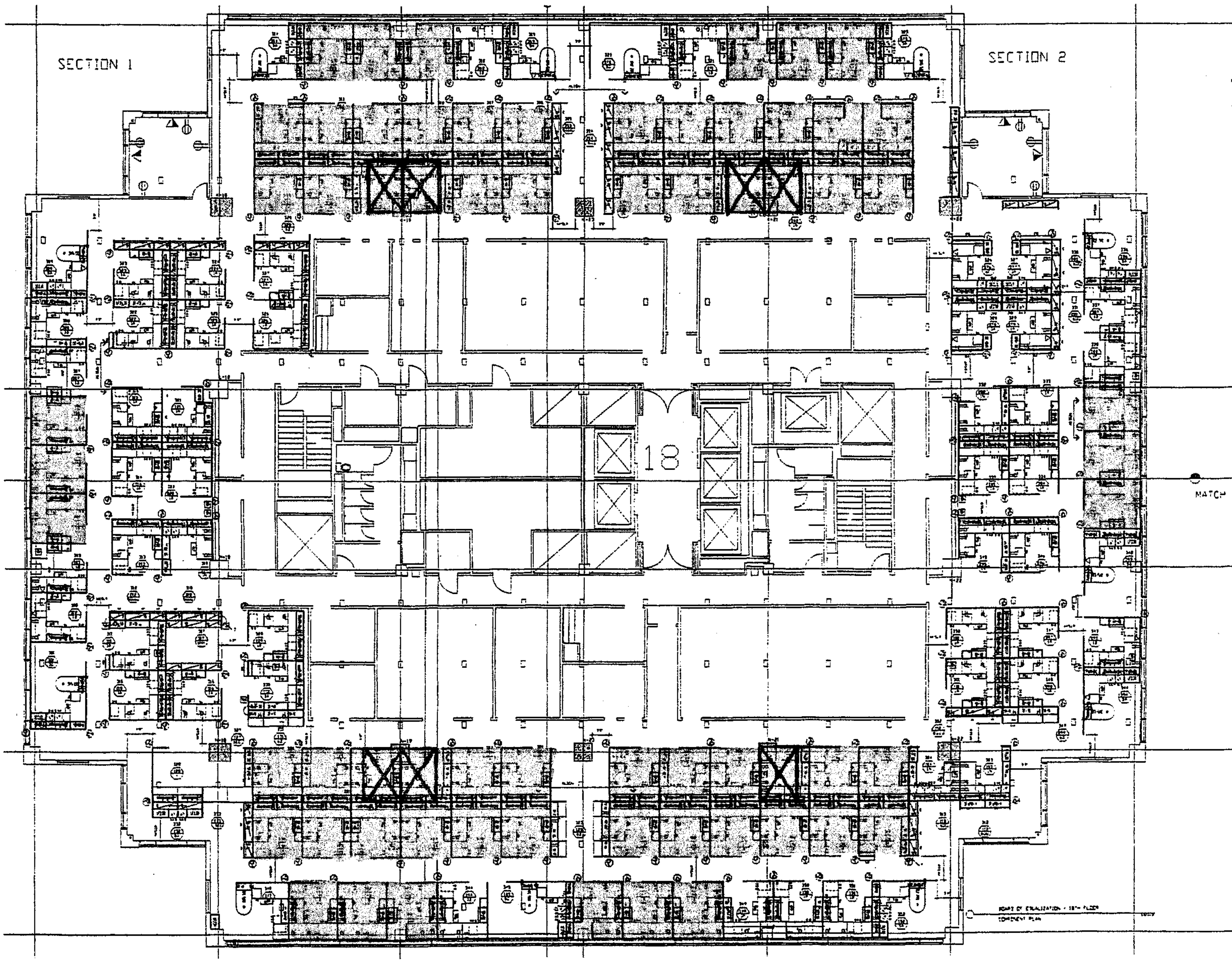
NOTE
INSIDE CLEAR DIMENSIONS FOR EACH AREA ARE GIVE
ANY DISCREPANCY IN ACTUAL FIELD DIMENSION COUL
BE CRITICAL AND CAUSE PLANS AND PRODUCT SPECI
TO CHANGE WCF MUST BE NOTIFIED

ELECTRICAL NOTES

FLOOR 18

66 (E) @ 72 ¢
CONVERT TO
81 (H) @ 54 ¢

+15 W.S.

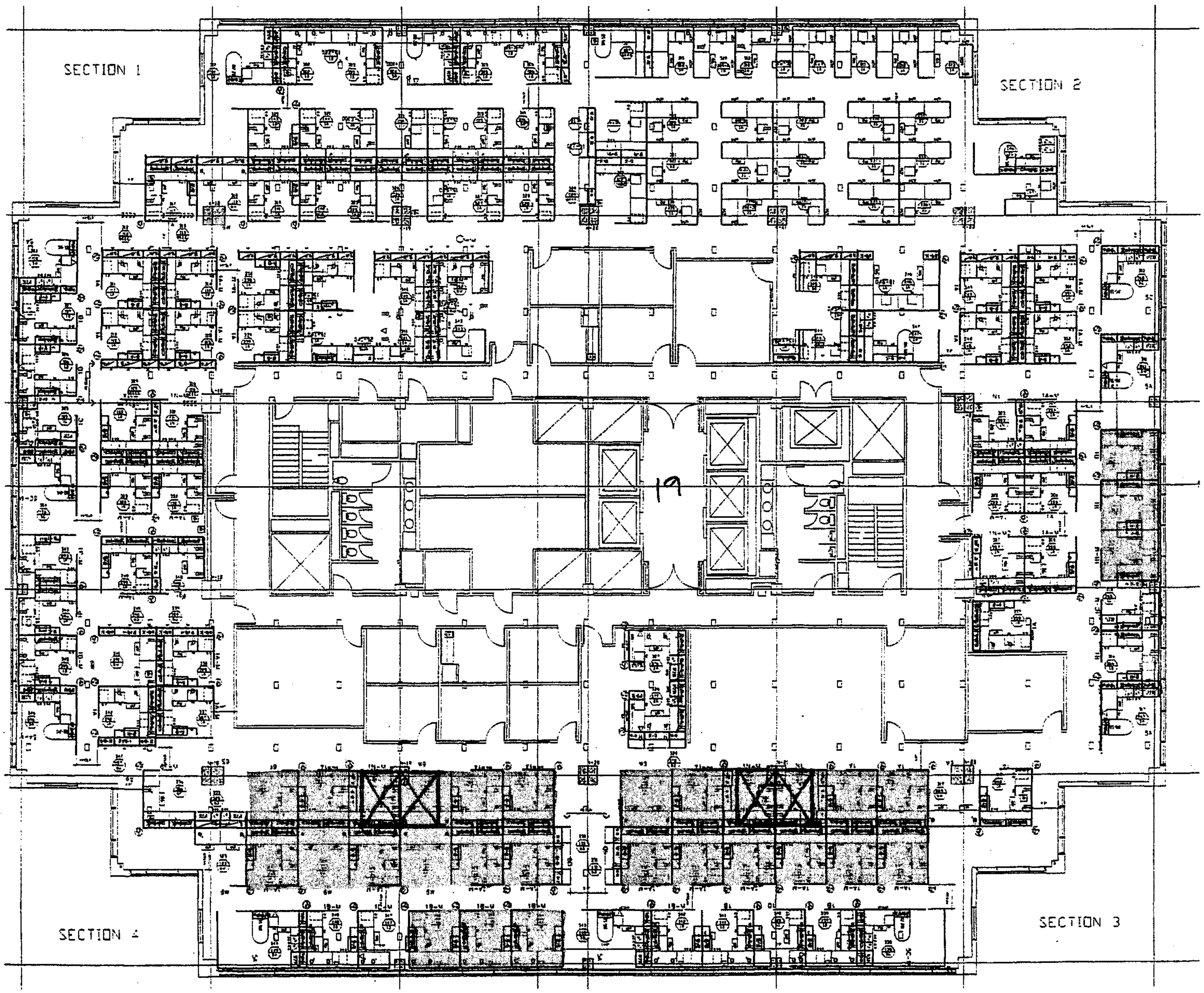


GENERAL NOTES

HAWORTH KEY #
STATION NUMBER
TYPICAL

NOTE
INSIDE CLEAR DIMENSIONS FOR EACH AREA ARE GIVEN. ANY DISCREPANCY IN ACTUAL FIELD DIMENSION COULD BE CRITICAL AND CAUSE PLANS AND PRODUCT SPECIFI[illegible] TO CHANGE. WCF MUST BE NOTIFIED

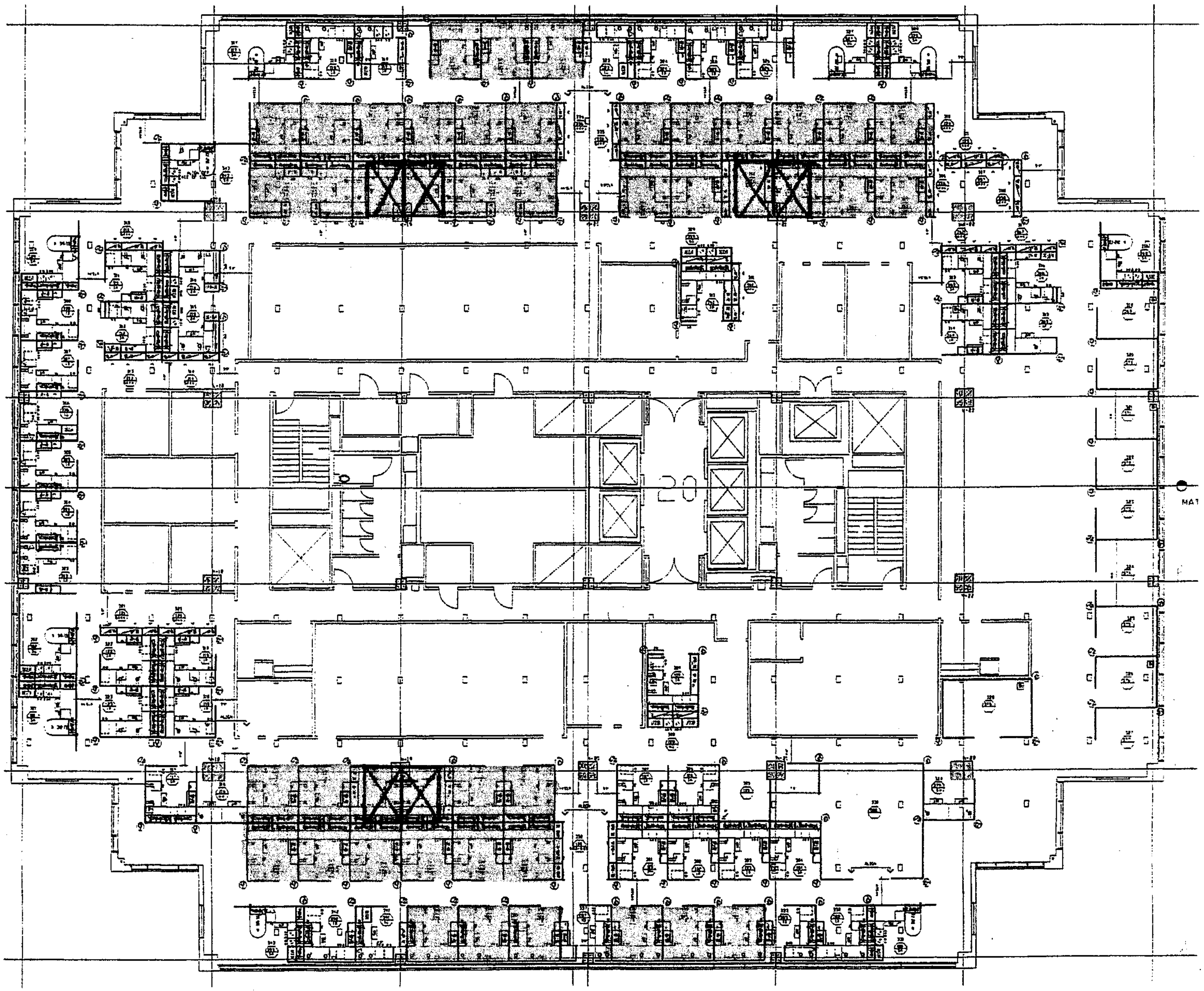
ELECTRICAL NOTES



OPTION # 2
FLOOR 19

25 (E) @ 72 ф
5 FILE AREAS
CONVERT TO
36 (N) @ 54 ф

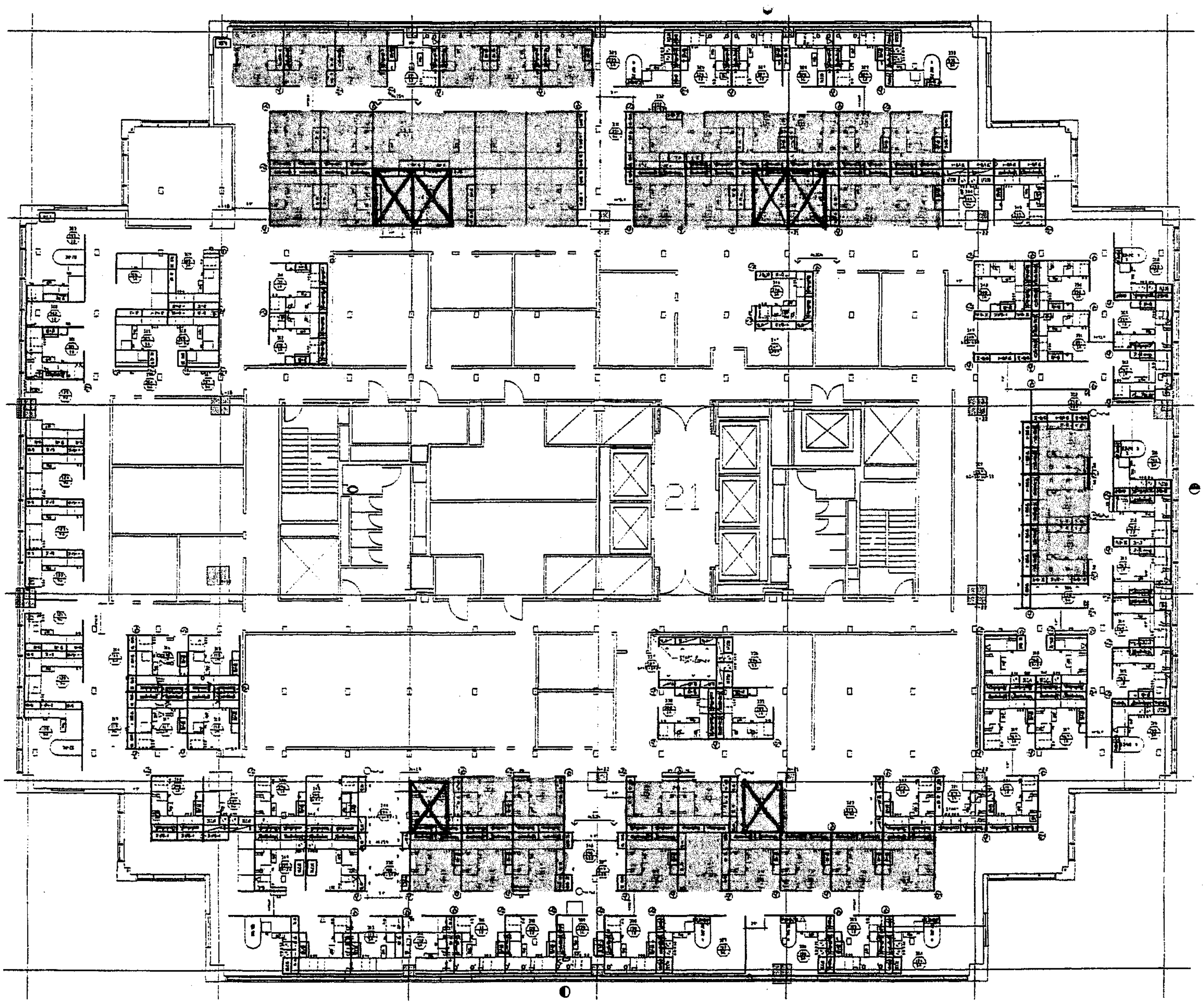
+ 11 W.S.



OPTION #2
FLOOR 20

44 (E) @ 72 ф
1 FILE AREA
CONVERT TO
54 (N) @ 54 ф

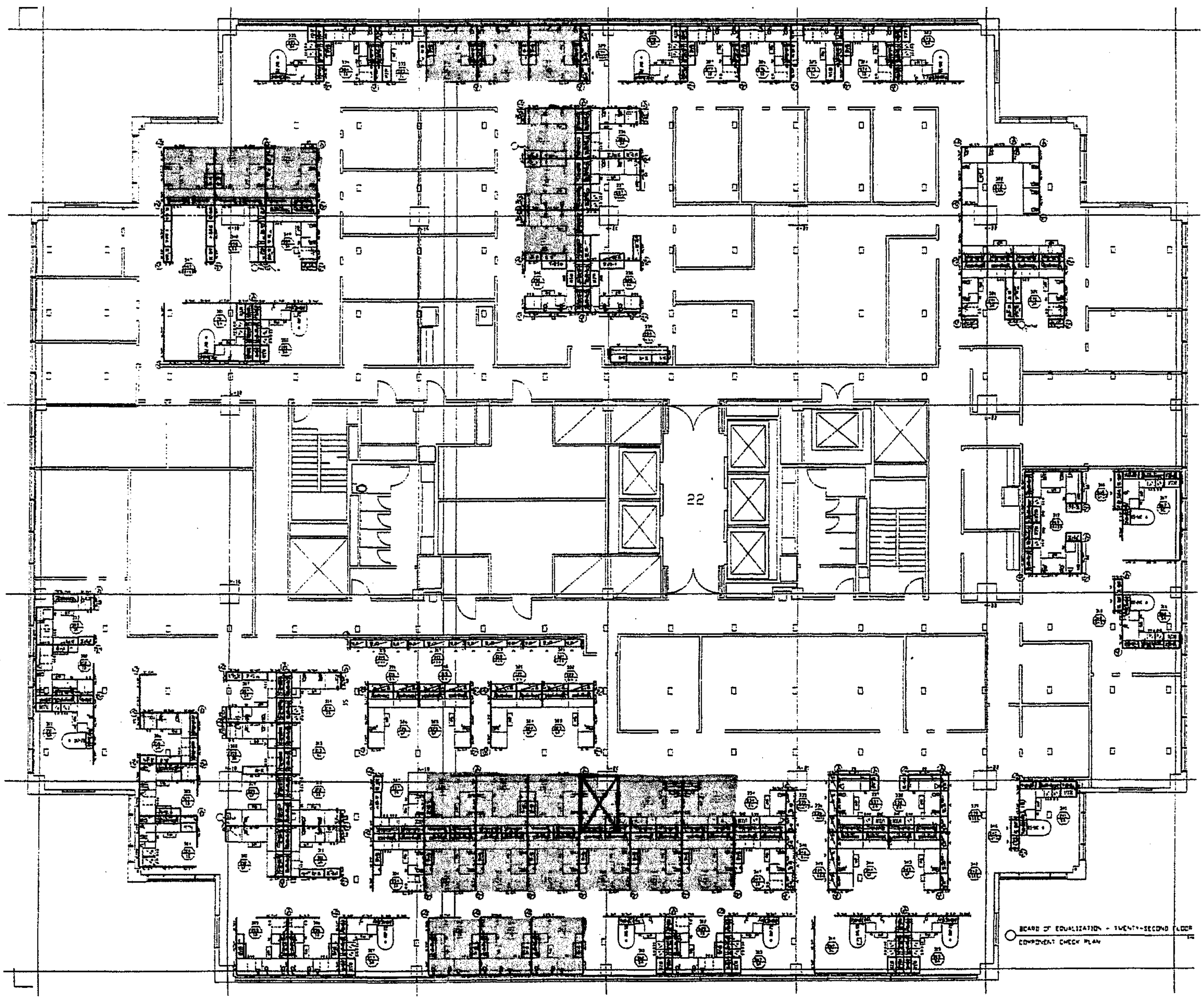
+10 W.S.



OPTION #2
FLOOR 21

44 (E) @ 72 ¢
4 FILE AREAS
CONVERT TO
58 (N) @ 54 ¢

+14 W.S.



OPTION #2
FLOOR 22

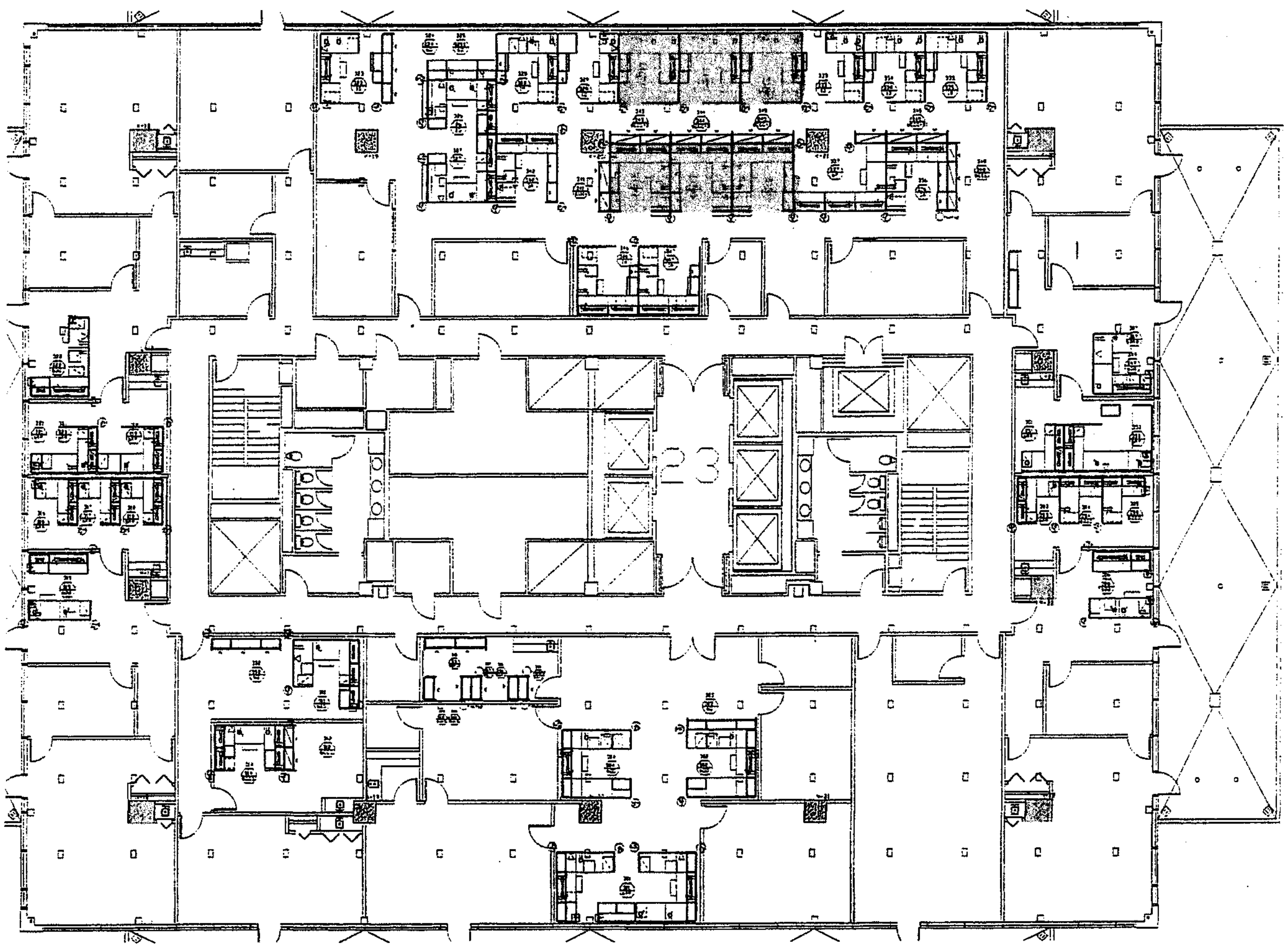
24 (E) @ 72 ¢
CONVERT TO
31 (H) @ 54 ¢

+ 7 W.S.

OPTION #2
FLOOR 23

6 (E) @ 72 ¢
CONVERT TO
8 (N) @ 54 ¢

+ 2 N.S.



(916) 638-3338

PROPRIETORY NOTE

DESIGNER AGENCY

DRAWN BY BY

CHECKED BY

FILENAME ST670-23.VWF

BOARD OF EQUALIZATION
450 'N' STREET
SACRAMENTO, CALIFORNIA.

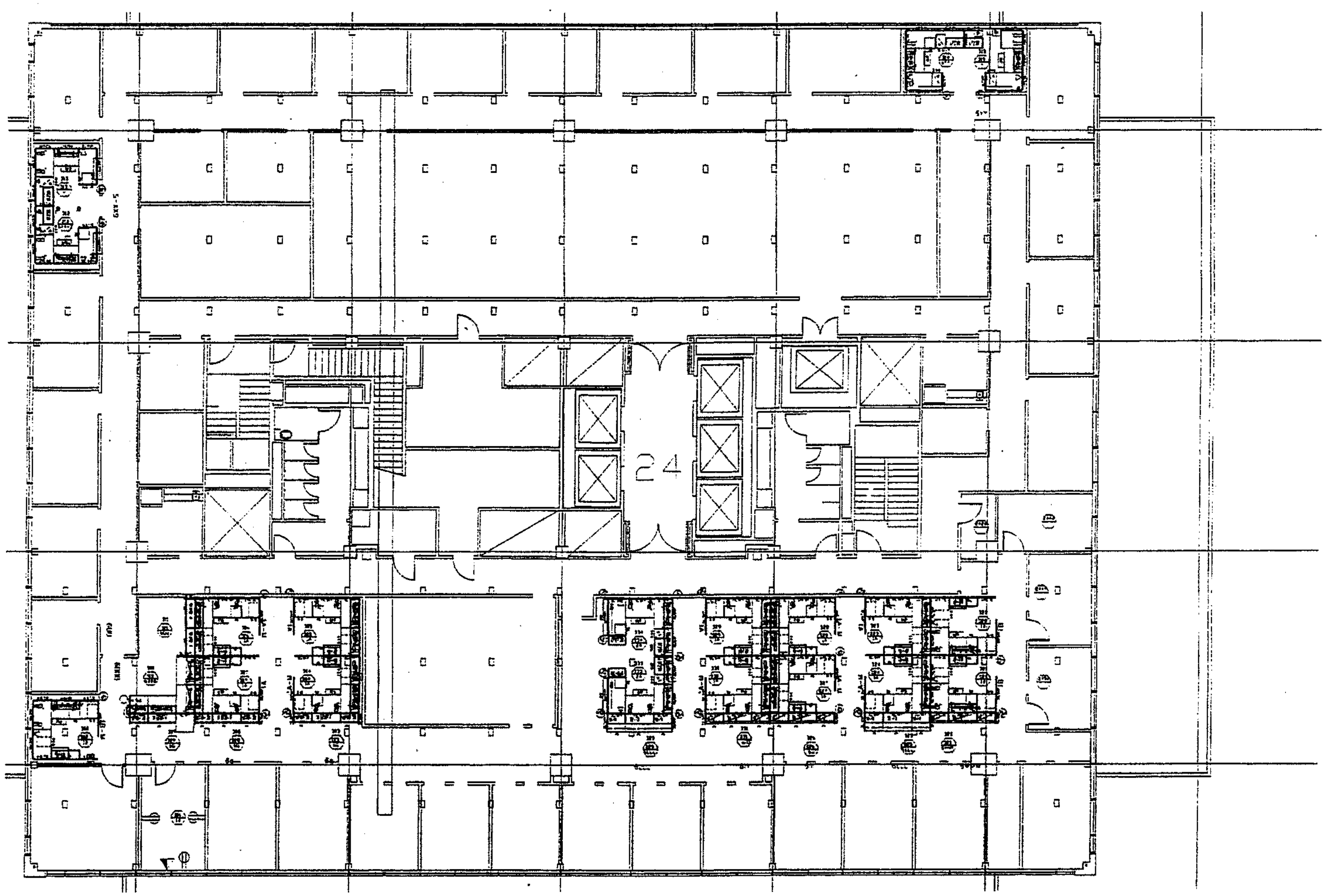
REVISIONS

DATE 10-2-92

SCALE 3/16"=1'-0"

SHEET TITLE

FLOOR 24



9

INFRASTRUCTURE REVIEW

Capital Engineering Consultants, Inc.
7300 Folsom Blvd., Suite 100
Sacramento, CA 95826
TEL: (916) 386-8888
FAX: (916) 386-2610

MEMO

DATE: May 20, 1997

TO: DREYFUSS BLACKFORD ARCHITECTS
3540 Folsom Boulevard
Sacramento, CA 95816

PROJECT: STATE BOE OPTIMIZATION PROJECT

ATTN: Peter Saucerman

PROJECT NO.: 970209

FROM: Scott Karpinen, P.E.

SUBJECT:

Unless immediately advised we assume this information to be correct.

I am following up on my previous memo dated May 7, 1997.

In analyzing some of the chiller log data, we have verified that the two (2) original chillers have some capacity remaining. The chillers seem to be running at about 80% capacity for a design day (see attached). This does not include the additional 75 tons available with the chiller that was added in the T.I. stage. The only downside to adding additional load to these chillers is the reduced system capacity should one of the chillers fail.

A problem, as mentioned in the previous memo, appears to be the lack of additional airflow. The fans are currently operating around 90% capacity. Increasing the fan speed may cause vibration problems. In our opinion, the fan speed should not be increased without modifying the bases and/or supports for these fans.

An increase to the building population of 22% will have substantial mechanical impacts and will require supplementary fan systems. A population increase of 11% should work, however, a few adjustments may need to occur:

1. Our first recommendation would be to adjust the supply air temperature (by means of controls) down a few degrees to supplement the additional cooling requirement.

2. Testing of the existing hydronic system should be performed to verify that the existing pumps and coils are operating at peak capacity.

3. An updated room by room calculation is needed in order to more closely model the proposed occupancy loading.

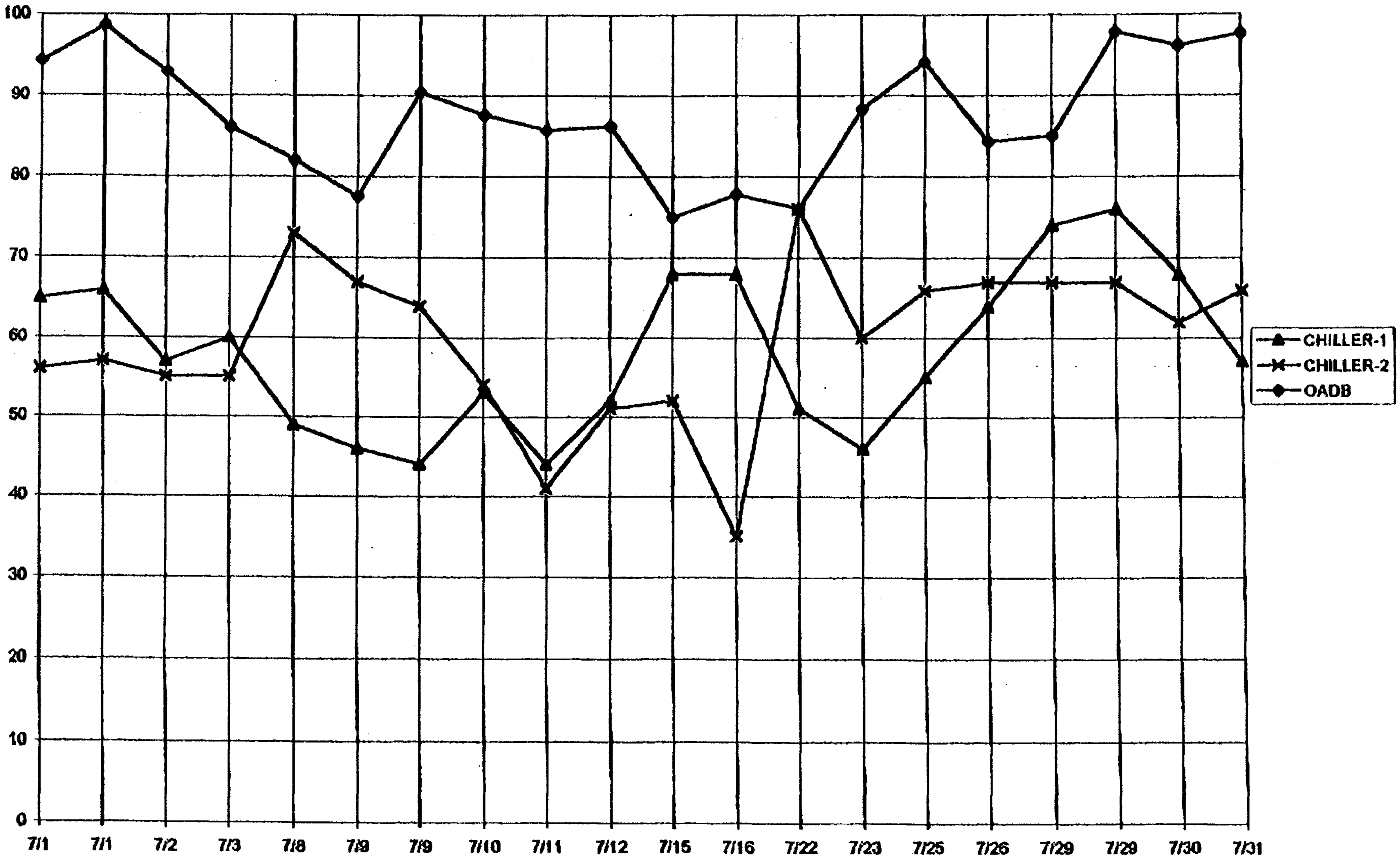
4. If certain floors still lack the required airflow, the addition of new chilled water fan coils would be a viable option.

Please call with any questions.

CAPITAL SQUARE CHILLER LOADING
(1996)

DATE	TIME	ODB (DEG F.)	CHILLER-1 CAPACITY (%)	CHILLER-2 CAPACITY (%)	TOTAL CAPACITY (%)
7/1	14:00	94.4	65	56	61
7/1	17:40	98.6	66	57	62
7/2	15:30	93	57	55	56
7/3	15:30	86	60	55	58
7/8	15:00	82	49	73	61
7/9	11:45	77.6	46	67	57
7/9	17:25	90.4	44	64	54
7/10	17:33	87.6	53	54	54
7/11	17:40	85.7	44	41	43
7/12	17:30	86.2	52	51	52
7/15	13:30	75	68	52	60
7/16	17:36	77.8	68	35	52
7/22	10:45	76.1	51	76	64
7/23	17:36	88.3	46	60	53
7/25	17:20	94.2	55	66	61
7/26	17:35	84.3	64	67	66
7/29	11:30	85	74	67	71
7/29	15:30	97.8	76	67	72
7/30	17:30	96.2	68	62	65
7/31	17:15	97.6	57	66	62
8/1	17:25	83.9	53	73	63
8/2	17:25	88.5	49	62	56
8/7	17:30	87.6	49	51	50
8/8	12:00	82.6	58	52	55
8/8	17:10	?	61	55	58
8/12	11:30	81.6	70	62	66
8/13	10:00	78.4	53	67	60
8/13	16:00	99.4	84	56	70
8/14	16:30	96	99	55	77
8/16	17:26	91.4	42	66	54
8/21	17:23	91.4	54	48	51
8/28	17:24	94	59	51	55
8/30	17:35	94.8	58	59	59

CAPITAL SQUARE CHILLER PROFILE



Capital Engineering Consultants, Inc.

7300 Folsom Boulevard
Sacramento, California 95826
916•386•8888
Fax•386•2610

TO: Peter Saucerman
DREYFUSS & BLACKFORD ARCHITECTS
3540 Folsom Boulevard
Sacramento, CA 95816

MEETING

OTHER

TELEPHONE

FROM: Scott Karpinen, P.E.

DATE: May 7, 1997

PROJECT: STATE BOE OPTIMIZATION PROJECT

Unless immediately advised we assume this information to be correct.	Action By

MEMO:

Peter,

We have reviewed the updated population and equipment spreadsheets for this project. The following summarizes our results.

Our original design was based upon an occupant density of 150 sf/person with a combined total of 3290 people. A miscellaneous equipment load of 1.5 watts/sf was used throughout. Our design used 80,000 cfm of outside air as a minimum that is approximately 16% of supply air.

Option 1 (worst case) would have an occupant density around 160 sf/person and a miscellaneous equipment load of 1.3 watts/sf. The outside air could remain at 80,000 cfm.

Based on calculations, the proposed occupancy and equipment changes for Option 1 should still be within the capacity of the main cooling system (chillers, pumps, coils). A few floors, however, lack the airflow needed due to high occupancy loading. It may be possible to shift some of the air from floors with a less airflow requirement or perhaps add additional unitary equipment to supplement the problem areas. Another possibility might be to even out the occupant distribution throughout the various floors. To verify any of this, a more intensive load calculation would have to be run. A more radical approach would be to enlarge the motors on the supply fans and generate higher volumes of airflow from the existing equipment. This could have significant cost implications.

Our assumptions are based on a review of the existing load calculations. Due to system and building modifications, the calculations may not reflect the current conditions. The existing load and capacity should be verified through review of chiller logs, airflow trend reports from the energy management system and some spot testing of flows. This will enable us to baseline the calculations to actual

(FAXED 5-7)

conditions and give a more accurate indication of the effects of the proposed population increases.

We are in the process of accessing this additional data.

Please call with any questions...

ECOM Engineering

June 13, 1997

Dreyfuss & Blackford
3540 Folsom Blvd.
Sacramento, CA. 95816

Attention: Peter Saucerman

Subject: B.O.E. Office Optimization Study
ECOM Job #970205

Dear Peter:

As per your request, we have reviewed the two (2) proposed population studies for the above project. We have reviewed the record electrical drawings and contacted the electrical utility service, SMUD , in order to determine the current benchmark for peak power. A brief summary of the electrical impact is as follows:

- The building is supplied electrical power by two (2) main switchboards, located across from each other in the main electrical room.

- East electrical service is 5000 amp, 277/480 V. Currently at 46% capacity. Serves the building hvac loads.

- West electrical service is 5000 amp, 277/480 V. Currently at 39% capacity. Serves the building tenant loads, i.e. lighting, receptacles, etc.

- Typical floors have 150 kVA of 120/208 V power available from step down transformers. Assuming 80% of the 120/208 V power is dedicated to the workstations, this amounts to about 6.5 amps @ 120V per workstation.

- The proposed average of 22% additional workstations, (Option #1) would limit each workstation to about 5.0 amps @ 120V. The proposed average of 11% additional workstations, (Option #2) would limit each workstation to about 5.8 amps @ 120V. Both options would severly limit the current workstation power requirements based on the following list.

5323 53rd Avenue, Sacramento, CA 95823 Phone 916.424.5323 Fax 916.424.5779

The average single PC workstation currently consists of the following:

1. PC - computer	2.0 A
2. Monitor - standard	2.1 A
3. Task Lights	1.26 A
4. Telephone Set	0.38 A
5. Calculator	0.13 A
Total Load per workstation	**5.90 A**

In several workstation locations, the above equipment is utilized plus the following:

1. PC - computer	6.0 A
2. Monitor - Large Format	3.7 A
Total Load per workstation	**15.6 A**

In addition to the equipment listed, a printer is typically shared between an average of 4-5 users.

1. Laser Printer	**9.0 A**

Therefore, additional 120 V power would be required using either option. This will require the addition of a 480-120/208V transformer and 120/208 V panelboard for each floor. Diversity factors have not been included due to code limitations based upon connected loads.

- All new conductors would require "poke-thru" floor devices, in order to serve the additional equipment. This is due to the high density of existing conductors already in the floor duct system.

- The mechanical system is currently utilizing (2) 700 ton units and (1) 150 ton unit. The 150 ton unit can only operate at 50% of capacity due too distribution limitations. This unit is presently operated for the computer loads.

- The potential increase of air handling equipment will require substantial power upgrades to the existing distribution panels.

- Exact upgrades of the electrical distribution system will require detailed hvac information and detailed site survey of existing electrical distribution systems.

Should you have any questions, please do not hesitate to call.

Very truly yours,

ECOM Engineering

Eric C. Johnson, P.E.
ECJ:pc

EXISTING CONDITIONS

Electrical Systems

The building electrical power is supplied by two main switchboards, located in the main electrical room. One service is dedicated for all mechanical loads for the building, the other service is for the building occupants, i.e. lighting, receptacles.

Both services are rated 5000 amp, 277/480 V. The main switchboard for mechanical loads is currently at 46% capacity, while the building main switchboard is currently at 39% capacity.

Typical floors have 150 kVA of 120/208 V power available. Assuming 80% of this power is dedicated to workstations, this amounts to about 6.5 amps @120 V, per workstation.

Telecommunication Systems

A. Voice

The building is currently utilizing an off-site PBX switch (Pac-Bell CMS Centrex System). Programming is performed by B.O.E. staff via modem.

Maximum capacity of the trunk line is 3600 pairs. Currently 2200 pairs in use.

Telecom Closet Voice Capacity is as follows:

Floors 1-11	....	Max. 248 voice feeds/floor
Floors 14-22	....	Max. 216 voice feeds/floor
Floors 23-24	....	Max. 124 voice feeds/floor

Two voice jacks are provided to each workstation using (1) 4 pair, Category 3 cable, split with two pair to each jack. The building horizontal cabling does not comply with ANSI/EIA/TIA standards.

Both Options #1 & #2 are within the current capacity of the infrastructure.

B. Data

The building data backbone is distributed from the MDF located on the 5th floor.

Maximum capacity of the trunk line is 3600 pairs. Currently 2200 pairs utilized.

Telecom Closet Data Capacity is as follows:

Floors 1-11	....	Max. 288 low speed feeds/floor
Floors 1-11	....	Max. 288 high speed feeds/floor
Floors 14-22	....	Max. 216 low speed feeds/floor
Floors 14-22	....	Max. 216 high speed feeds/floor
Floors 23-24	....	Max. 144 low speed feeds/floor
Floors 23-24	....	Max. 144 high speed feeds/floor

Two low speed and two high speed jacks are provided t each station using two (4) pair cable, with split pairs to each jack. Low speed cable is CAT 3 and high speed cable is CAT 5. The building cabling installation does not comply with ANSI/EIA/TIA standards for horizontal cable.

Both Options #1 & #2 will require additional active electronic equipment, i.e. hubs. Option #1 will require additional rack equipment due to the limited space available in the existing equipment rack.

Security/Access Control System

A. Access Control

The building is currently utilizing a Westinghouse Access control system, which operates with passive card reading technology. The software used for the security system database, is Receptors, GT-3. The current maximum quantity of access cards is 10,000. The approximate quantity in use currently is 2,300.

RECONFIGURATION ANALYSIS

Option #1

Electrical Impact

The electrical impact of this configuration (worst case), adding an average of 22% additional workstations, would limit existing and new workstations to about 5.0 amps @ 120 V, each.

Therefore, additional 120 V power would be required using this option. This will require the addition of a 480-120/208V transformer and 120/208 V panelboard for each floor. Diversity factors have not been included due to code limitations based upon connected loads.

Telecommunication Impact

This option would require additional active electronics, i.e. hubs , to support both the low and high speed data networks. Area workgroups would also become a factor of how many hubs are required.

The addition of voice drops would be required to the workstations, but the quantity shown is within the capacity of the voice system.

Access Control Impact

The access control system for the building can support this option.

Option #2

Electrical Impact

The electrical impact of this configuration (worst case), adding an average of 11% additional workstations, would limit existing and new workstations to about 5.8 amps @ 120 V, each.

Therefore, additional 120 V power would be required using this option. This will require the addition of a 480-120/208V transformer and 120/208 V panelboard for each floor. Diversity factors have not been included due to code limitations based upon connected loads.

Telecommunication Impact

This option would require additional active electronics, i.e. hubs , to support both the low and high speed data networks. Area workgroups would also become a factor of how many hubs are required. Fewer hubs would be required than under the Option #1 requirements.

The addition of voice drops would be required to the workstations, but the quantity shown is within the capacity of the voice system.

Access Control Impact

The access control system for the building can support this option.

HKA

Hesselberg, Keesee & Associates, Inc., Consulting Elevator Engineers

July 28, 1997

Mr. Peter Saucerman
Dreyfuss & Blackford Architects
3540 Folsom Boulevard
Sacramento, California 95816

Reference: State Board of Equalization
Optimization Project

Subject: Analysis of Existing Vertical Transportation System

Dear Peter:

We wish to present our report of the existing traffic handling capacity of the high and low rise elevators and comment upon the effect of additional population in both high and low rise elevator groups. We have prepared the report based on theoretical handling capacities and the recording data provided from Dover Elevator Company. Dover Elevator Company had considerable trouble providing this documented information due to malfunctioning of their recording instruments and, therefore, only 2 days of information has been provided to HKA. If additional recordings are provided by Dover Elevator Company which changes our report, we will provide a Supplementary Report.

Traffic Handling Design Criteria

The adequacy of elevator service is related to the length of time passengers wait for service and the ability of the elevator system to handle people as they require service. Standards for the comparison and evaluation of two theoretical basic measurements of elevator service have been developed, these standards are termed "average interval" and "handling capacity".

The average interval is the average frequency of elevators being dispatched from the main terminal loading floor averaged over a specific time period. Average interval is not a direct measure of how long perspective passengers wait for service. However, it is a value which can be calculated relatively easily and the accuracy of such calculations have been verified by countless tests. Such tests indicate that the average passenger waiting time for service at a typical intermediate floor approximates 60% to 65% of the average interval during heavy two-way traffic periods.

The elevator group should be capable of handling 12.5% of the group population in a five minute peak period with an average interval of 30 seconds or less. This is the design criteria required by the State of California and has been adopted in numerous State buildings.

For two-way traffic, which is experienced at mid morning, noon time and mid afternoon, the group should be able to handle the traffic with the acceptable average interval of 30 seconds or less.

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POPULATION FIGURES

We have shown below the existing population figures and the proposed additional populations

		Option 1	Option 2
	Existing Population	Proposed Population	Proposed Population
Low Rise Elevators	1173	1429	1304
High Rise Elevators	1144	1393	1260
Building Total	2317	2822	2564

THEORETICAL CALCULATION RESULTS WITH INCREASED TRAFFIC

High Rise Elevators

The 12.5% of the proposed high rise population of 1393 (Option 1) can not be handled in a 5 minute peak period and still achieve a 30 second average interval. 10% of the proposed population could be handled in 5 minutes and achieve a 30 second average interval with 14 persons loading per car. The average round trip time would be 149 seconds. The 12.5% of the proposed high rise population of 1260 (Option 2) can not be handled in a 5 minute peak period and still achieve a 30 second average interval. 11% addition for Option 2 population could be handled within the 30 second interval.

Low Rise Elevators

The 12.5% of the proposed low rise population of 1429 (Option 1) or 1304 (Option 2) can not be handled in a 5 minute peak period and achieve a 30 second average interval. Approximately 7.5% of Option 1's population and 10% of Option 2's population can be handled in a 5 minute peak period with a 30 second average interval.

The physical size of the elevator cabs will not allow for loading of cars greater than 12 to 14 persons. People will not load cars greater than is their comfort level and, therefore, will cause additional hall calls to be placed due to their non entry to elevators. The overall result being longer waiting intervals at the floors and increased numbers of hall calls.

ELEVATOR GROUP OBSERVATION SUMMARY

On June 4, 1997, we surveyed the general elevator traffic flow within the building. This consisted of going floor to floor and randomly recording waiting times during non peak and peak periods for each group of elevators.

The low rise elevator group wait period varied from 5 seconds to 45 seconds, which resulted in an average waiting time of 21 seconds. Each car that left the 1st Floor was heavily loaded, up to 12 persons per floor. The recorded information taken on June 10, showed a similar average wait period of 20 seconds.

The high rise group wait periods at the 1st Floor varied from 5 seconds to 75 seconds, which results in an average wait time of 31.5 seconds. Each car leaving the 1st Floor was more heavily loaded between 12-15 persons. The longest wait period was between 1:00 PM - 1:15 PM. The analyzed recorded information taken on June 10th and 11th showed much lower average wait periods of 17 seconds at the 1st Floor. The vast difference in these figures is of concern, with the only explanation being there was less population in the high rise group on these two days.

ANALYSIS OF RECORDED INFORMATION

The recordings were taken on June 10th & 11th. The actual population of the building on these days is unknown.

The average waiting times at the 1st Floor Lobby during the peak periods of the day were studied, together with the floor hall call requirements over the full day period. The early morning peaks have the least waiting periods as the building is not occupied and inter-floor traffic has not commenced.

Low Rise Elevator Group

The number of hall calls at the 1st Floor remain consistent for each 15 minute period up to 12:30 PM. The waiting times increased progressively with the longest individual waits occurring between 9:00 AM to 9:45 AM (81 seconds) and 11:30 AM to 12:30 PM (87 seconds). The average waiting time over each 15 minute period did not exceed 20 seconds. The average wait period of 20 seconds would equate to a 30 second average interval.

The Noon to 5:00 PM 1st Floor analysis showed hall call numbers were similar to the morning period up to 3:15 PM. The longest individual wait times were between 1:00 PM to 1:30 PM (72 seconds) and 3:00 PM to 3:45 PM (81 seconds). The average waits over each of the 15 minute periods did not exceed 21 seconds.

We reviewed the total numbers of UP and DOWN hall calls at each floor above the 1st Floor and have listed them below in two periods of time. Additionally, we have listed the overall daily response results for June 10th.

Low Rise

Time Period ***7:00 AM - 12 Noon***

Floor #	# of Calls	Average Wait	Longest Wait	
2	39	16.3	50 Sec.	8:45 am
3	132	18.0	93 Sec.	9:45 am
4	129	16.3	77 Sec.	Noon
5	145	15.2	77 Sec.	Noon
6	151	16.6	76 Sec.	Noon
7	128	18.8	88 Sec.	9:15 am
8	185	14.1	64 Sec.	9:30 am
9	178	17.5	72 Sec.	Noon
10	149	15.0	66 Sec.	11:30 am
11	No recordings for Floor 11			

Low Rise

	Time Period		*12 Noon - 5:00 PM*	
Floor #	**# of Calls**	**Average Wait**	**Longest Wait**	
2	28	18	50 Sec.	2:45 pm
3	91	12.9	93 Sec.	3:45 pm
4	92	15.1	73 Sec.	4:00 pm
5	105	13.7	54 Sec.	2:45 pm
6	102	15.1	60 Sec.	3:50 pm
7	88	18.5	88 Sec.	3:50 pm
8	136	11.7	64 Sec.	3:30 pm
9	132	17.1	55 Sec.	3:00 pm
10	106	12.4	64 Sec.	3:30 pm
11	No recordings for Floor 11			

Low Rise

Time Period	Total Calls	Longest Call	Average Wait (sec.)
7:00 AM	226	72	9.8
8:00 AM	261	54	10.8
9:00 AM	331	93	19.1
10:00 AM	274	73	11.7
11:00 AM	375	82	15.9
12:00 PM	338	106	18.5
1:00 PM	296	58	12.0
2:00 PM	373	87	16.0
3:00 PM	311	87	13.6
4:00 PM	299	63	13.7
5:00 PM	3	57	17.0

The standard criteria for the percentage of the hall calls answered within a waiting periods are as follows:

0 - 30 seconds	75% of calls answered	Good rating
0 - 15 seconds	75% of calls answered	Excellent rating

The results of the recorded information for June 10^{th} and 11^{th}, have been set out as follows:

June 10th	7:00 AM - 12 Noon	62.7% of the total calls were answered in less than 15 seconds average.
		85% of the total calls were answered in less than 30 seconds average.
	Noon - 5:00 PM	64.5% of the total calls were answered in less than 15 seconds average.
		87.3% of the total calls were answered in less than 30 seconds average.
June 11th	10:40 AM - 12:10 PM	66.3% of the total calls were answered in less than 15 seconds average..
		84% of the total calls were answered in less than 30 seconds average.
	12:10 PM - 4:25 PM	61.1% of the total calls were answered in less than 15 seconds average.
		83% of the total calls were answered in less than 30 seconds average.

LOW RISE GROUP RECOMMENDATIONS

The recorded information analysis results have shown that the existing four (4) low rise elevators can achieve the design criteria. Based on the satisfactory recorded results, the proposed Option 2, 11% population increase could be marginally handled by the group.

HIGH RISE ELEVATOR GROUP ANALYSIS

The number of hall calls at the 1^{st} Floor varied considerably over the two day recordings. There were 533 calls on June 10^{th} and 631 calls on June 11^{th}. These figures are considerably less than the comparative low rise calls of 944 on June 10^{th}.

The morning 1^{st} Floor peak hall call demands were between 7:00 AM - 7:30 AM with the longest wait being 66 seconds and between 11:00 AM - Noon, with the longest wait being 62 seconds. The afternoon demands were heavy between 1:00 PM - 1:30 PM and 3:00 - 3:30 PM. For the balance of the afternoon, traffic was considerably consistent except during the mid afternoon break period of 2:00 PM- 2:15 PM. The longest wait periods at the 1^{st} during the afternoon did not exceed 75 seconds.

The average wait time tables at the upper floors which we have provided for the high rise group shows much higher average waiting times than there is in the low rise group.

We have reviewed the total number of UP and DOWN hall calls at each floor above the 1^{st} Floor and have listed them below in the two main periods of time. Additionally, we have listed the overall response results for each day.

High Rise

Time Period ***7:00 AM - 12 Noon***

Floor #	# of Calls	Average Wait	Longest Wait	
11	120	27.0	153 Sec.	8:45 am
14	94	26.37	124 Sec.	9:45 am
15	97	24.32	95 Sec.	Noon
16	135	24.65	130 Sec.	Noon
17	103	21.9	102 Sec.	Noon
18	106	23.12	102 Sec.	9:15 am
19	126	25.4	131 Sec.	9:30 am
20	68	24.4	112 Sec.	Noon
21	89	26.4	112 Sec.	11:30 am
22	86	26.5	92 Sec.	Noon
23	42	25.3	113 Sec.	10:00 am
24	55	26.4	85 Sec.	9:45 am

High Rise

Time Period ***12:15 PM - 5:00 PM***

Floor #	# of Calls	Average Wait	Longest Wait	
11	155	26.9	109 Sec.	2:45 pm
14	124	26.2	87 Sec.	2:15 pm
15	118	25.7	105 Sec.	2:45 pm
16	137	24.8	80 Sec.	2:30 pm
17	76	26.0	110 Sec.	3:10 pm
18	113	26.8	108 Sec.	2:30 pm
19	151	25.2	113 Sec.	12:45 pm
20	91	26.5	89 Sec.	3:00 pm
21	77	24.9	87 Sec.	3:00 pm
22	125	24.2	82 Sec.	3:45 pm
23	51	23.7	65 Sec.	3:00 pm
24	77	20.8	714 Sec.	12:15 pm

JUNE 10TH

High Rise

Time Period	Total Calls	Longest Call	Average Wait (sec.)
7:00 AM	150	66	17.5
8:00 AM	224	66	17.45
9:00 AM	324	119	26.25
10:00 AM	256	153	27.12
11:00 AM	321	75	21.5
12:00 PM	358	113	30.65
1:00 PM	259	106	20.65
2:00 PM	312	109	24.77
3:00 PM	290	124	28.9
4:00 PM	359	77	24.25
5:00 PM	223	79	21.9

The recorded information on June 10 was studied and produced the following results:

Time Period	Response Time
7:00 AM - 9:00 AM	83% of Calls Answered in 30 seconds
9:00 AM - 10:00 AM	53% of Calls Answered in 30 seconds
10:000 AM - 11:00 AM	86% of Calls Answered in 30 seconds
11:00 AM - 1:00 PM	63% of Calls Answered in 30 seconds
1:00 PM - 2:00 PM	85% of Calls Answered in 30 seconds
2:00 PM - 5:00 PM	64% of Calls Answered in 30 seconds

JUNE 11TH

Time Period	Total Calls	Longest Call	Average Wait (sec.)
7:00 AM	153	77	18.3
8:00 AM	231	66	20.7
9:00 AM	319	110	25.0
10:00 AM	304	106	25.5
11:00 AM	No Information	No Information	No Information
12:00 PM	339	86	25.5
1:00 PM	231	81	19.0
2:00 PM	317	90	25.0
3:00 PM	303	98	26.1
4:00 PM	348	89	23.5
5:00 PM	234	92	26.0

HIGH RISE GROUP RECOMMENDATIONS

The theoretical calculations shows that only 11% of Option 2 population can be handled within the design criteria, the required 12.5% of population can not be achieved. Recorded results prove that any additional staff will further deteriorate the present poor condition to an unsatisfactory elevator service. We would recommend against implementing either Option 1 or 2.

After your review of this report, should you have any questions or if there is a need to have a meeting to discuss the ramifications of this traffic analysis, please contact our office.

Very truly yours,

HESSELBERG, KEESEE & ASSOCIATES, INC.

Paul J. Pitfield

Paul J. Pitfield
Vice President

PJP/kr